



## GRADE 3 MATH: CHRIS' GARDEN DILEMMA

### UNIT OVERVIEW

This unit contains a curriculum-embedded Common Core-aligned task and instructional supports. The task is embedded in a 3–4 week unit on solving real-world problems to reinforce the strategies of tiling, multiplication, addition, and area models to calculate the perimeter and area of polygons. This unit falls approximately between January and February in 3rd grade. At this point in 3rd grade students should have done substantial work with multiplication before beginning this unit. In 2nd grade, students should have received instruction in the following key concepts: repeated addition strategies, work with arrays to build the foundation for multiplication, and using appropriate tools to measure objects using standard units of measure. By 3rd grade, students develop an understanding of the structure of rectangular arrays and area. Also, students will recognize area as an attribute of two-dimensional regions. They measure the area of a shape by finding the total number of same-sized units of area required to cover the shape without gaps or overlaps, a square with sides of unit length being the standard unit of measuring area. Students connect area to multiplication and justify using multiplication to determine the area of a polygon. In 4th grade, students will apply their understanding of models for multiplication. In addition, students will apply formulas for rectangles to find the perimeter and area in solving real-world problems.

### TASK DETAILS

**Task Name:** Chris' Garden Dilemma

**Grade:** 3

**Subject:** Math

**Depth of Knowledge:** 1–3

**Task Description:** This task requires students to use multiplication, addition, tiling, and area models to determine perimeter and area. In addition, students will need to demonstrate and explain their reasoning of strategies used to solve the task.

**Standards:**

- 3.MD.5: Recognize area as attribute of plane figures and understand concepts of area measurement.
- a. A square with a side length of one unit, called a “unit square”, is said to have “one square unit” of area, and can be used to measure area.
- 3.MD.6: Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).
- 3.MD.7: Relate area to the operations of multiplication and addition.
- a. Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths.
  - b. Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real-world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning.
- 3.MD.8: Solve real-world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.

**Standards for Mathematical Practice:**

- MP.1 Make sense of problems and persevere in solving them.
- MP.2 Reason abstractly and quantitatively.
- MP.3 Construct viable arguments and critique the reasoning of others.
- MP.4 Model with mathematics.
- MP.5 Use appropriate tools strategically.
- MP.6 Attend to precision.
- MP.7 Look for and make use of structure.
- MP.8 Look for and express regularity in repeated reasoning.

**Materials Needed for Task Administration:**

- Grid paper
- Straightedge
- Tiles
- Pencils
- Additional paper to calculate solutions

# Mathematics



## TABLE OF CONTENTS

The task and instructional supports in the following pages are designed to help educators understand and implement Common Core–aligned tasks that are embedded in a unit of instruction. We have learned through our pilot work that focusing instruction on units anchored in rigorous Common Core–aligned assessments drives significant shifts in curriculum and pedagogy. Callout boxes and are included to provide ideas around how to include multiple entry points for diverse learners.

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Acknowledgements: This task and unit outline were developed by Yolanda Robinson, Common Core Math Fellow and math coach; Lauren Kish, Assistant Principal; Elise DiBattista, teacher; Carla Lopes, teacher; and Myra Pritchett, teacher from P.S. 68, CFN 607, Bronx, NY. Input was provided by the following Common Core Math Fellows: Jeneca Parker, Jenny Kim, Barbara Tully, and Cynthia Gehan.



## GRADE 3 MATH: CHRIS' GARDEN DILEMMA PERFORMANCE TASK

Name: \_\_\_\_\_

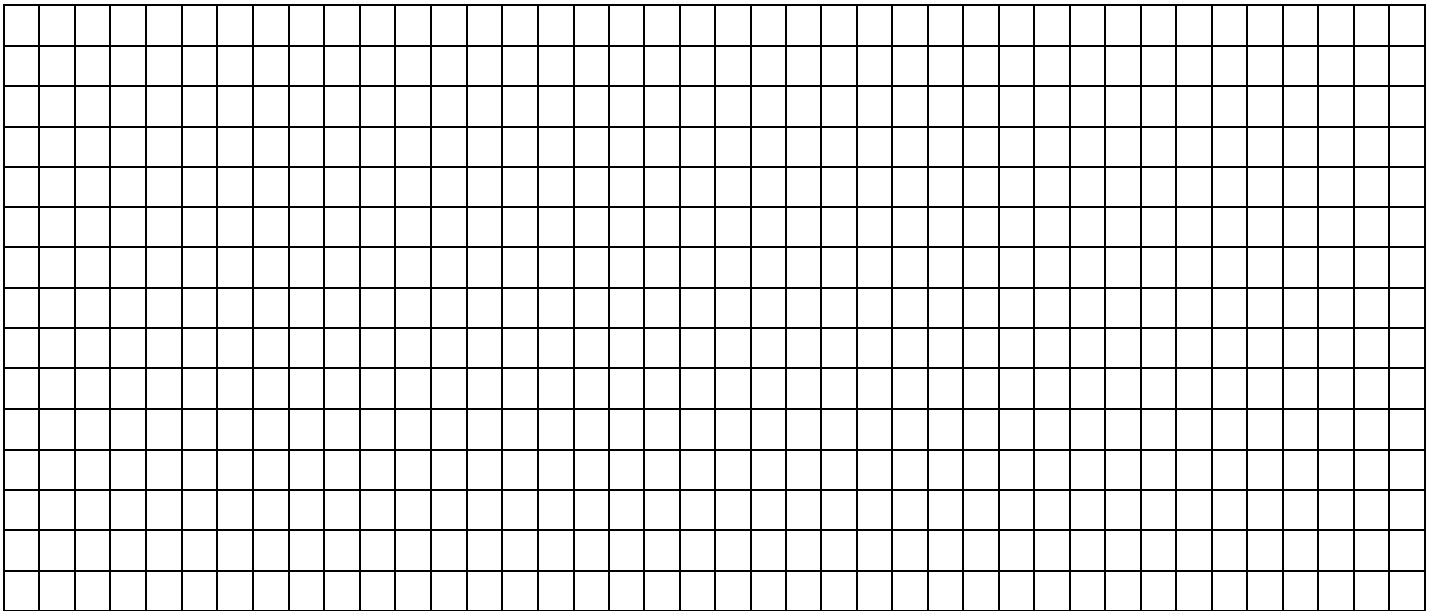
Date: \_\_\_\_\_



## Task: Chris' Garden Dilemma

Chris has a rectangular yard that covers an area of 40 square feet.

1. Draw the yard and label the length and the width.



2. Chris is not sure about how many feet of fencing he will need for the outside of the yard.

Write an equation that shows how to solve the problem.

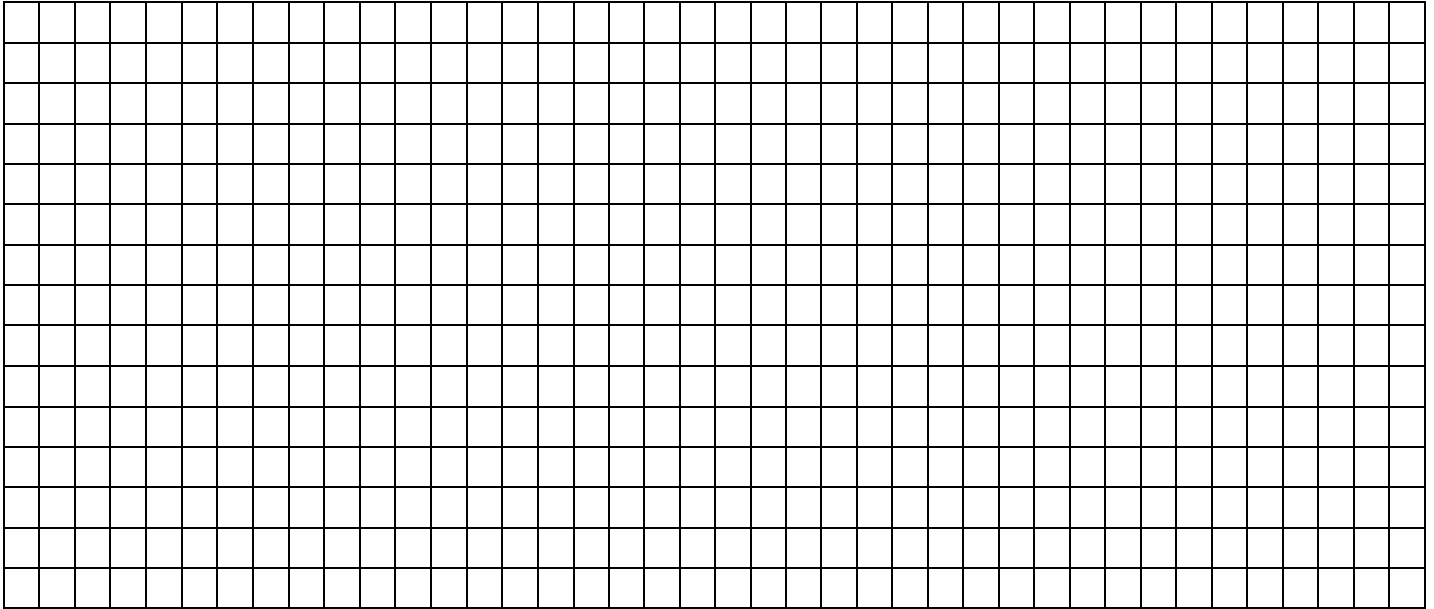
Equation: \_\_\_\_\_

How many feet of fencing would he need? \_\_\_\_\_ feet

- 3a. Chris wants to create a rectangular rose garden in the yard. He has 24 feet of garden fencing.

Show Chris **two** different ways he could construct the garden with different measurements of area.

**Draw and label each garden, including the area.**



**Garden 1 Area:** \_\_\_\_\_

**Garden 2 Area:** \_\_\_\_\_

- 3b. Which garden would you recommend that Chris choose? Explain your answer.

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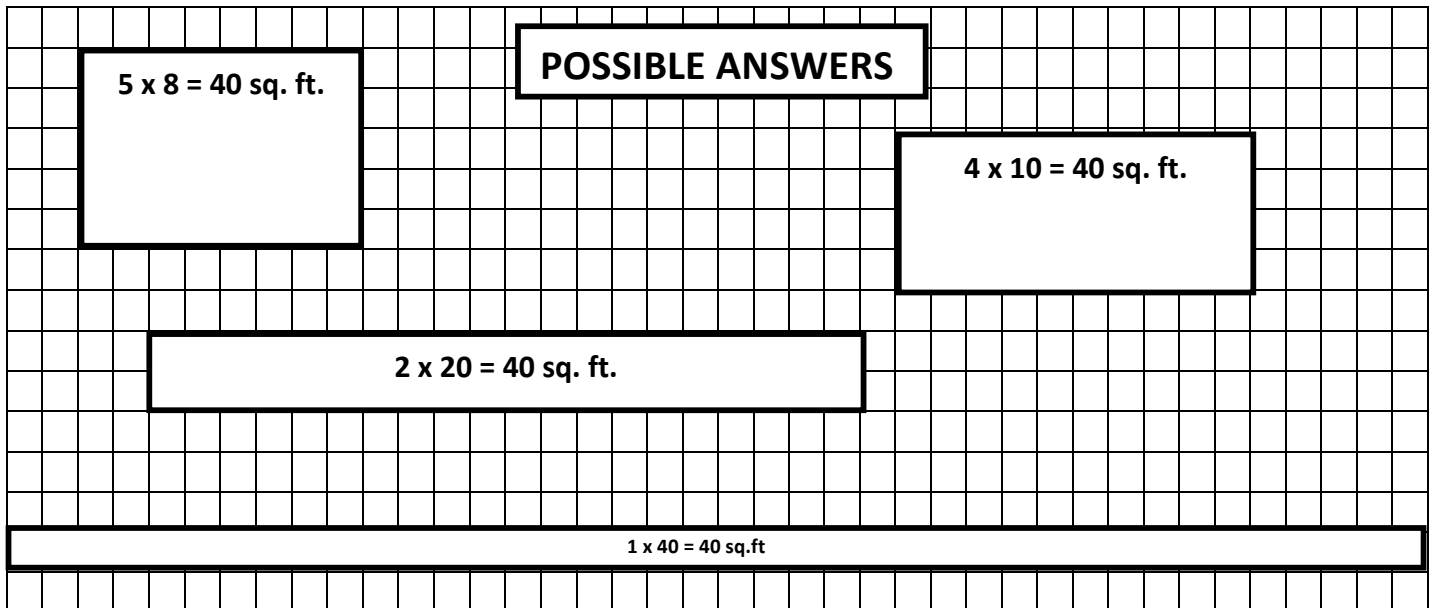
## ANSWER KEY



### Task: Chris' Garden Dilemma

Chris has a rectangular yard that covers an area of 40 square feet.

1. Draw the yard and label the length and the width.



2. Chris is not sure about how many feet of fencing he will need for the outside of the yard.

Write an equation that shows how to solve the problem.

Equation: Any valid addition equation such as:

$$2 + 2 + 20 + 20 = 44 \text{ ft.} \quad 8 + 8 + 5 + 5 = 26 \text{ ft.} \quad 10 + 10 + 4 + 4 = 28 \text{ ft.}$$

Any valid addition/multiplication equation such as:

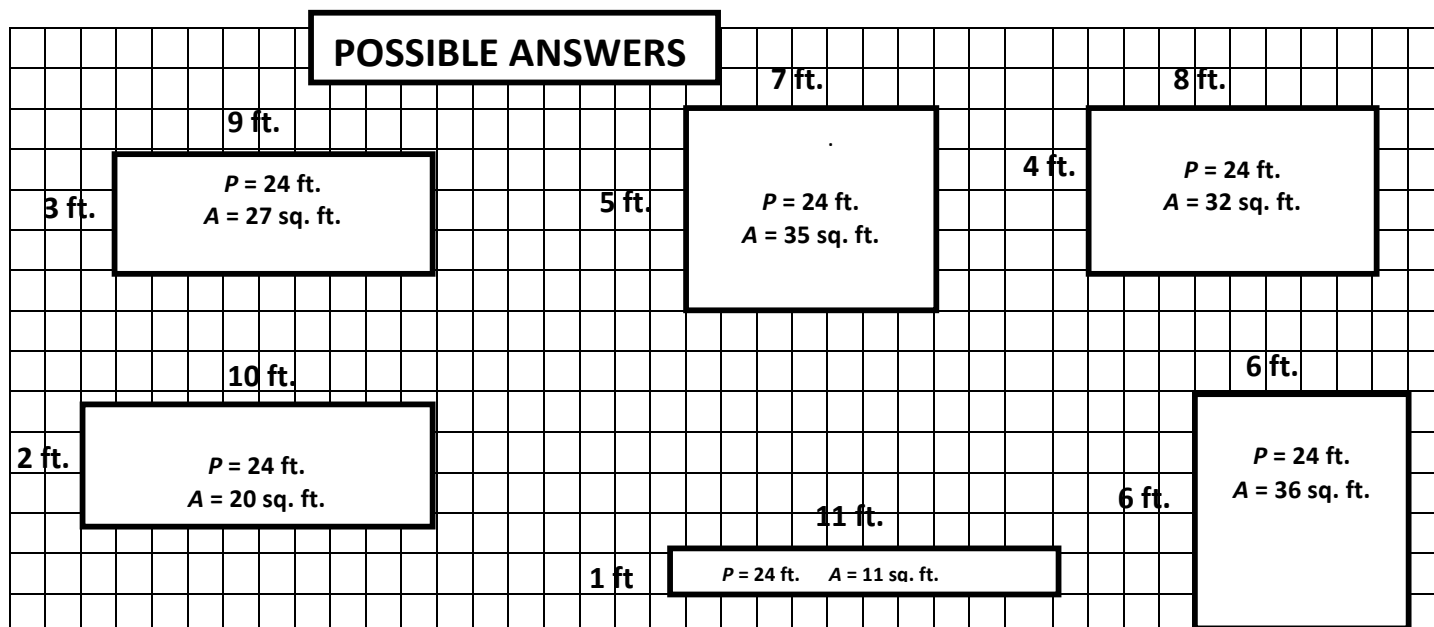
$$2(2) + 2(20) = 44 \text{ ft.} \quad 2(1) + 2(40) = 82 \text{ ft.}$$

How many feet of fencing would he need? 26, 28, 44, or 82 feet

- 3a. Chris wants to create a rectangular rose garden in the yard. He has 24 feet of garden fencing.

Show Chris **two** different ways he could construct the garden with different measurements of area.

Draw and label each garden, including the area.



**Garden 1 Area:** Any one of the above solutions      **Garden 2 Area:** Any other of the above solutions

- 3b. Which garden would you recommend that Chris choose? Explain your answer.

**Possible explanations or any other viable argument:**

I chose a garden with the area of 11 square feet, because it would cost me less money to fill it with plants.

**OR**

I chose a garden with the area of 36 square feet, because I can put more plants in it.

**TEACHER NOTES/INSTRUCTIONS**



**Time Required:** The task should take one 45-minute period to complete, but this is not a timed task.

**Suggested Materials:**

Pencils

Grid paper

Straightedge

Tiles (if needed)

Additional paper to calculate solutions (if needed)

**Pre-Assessment Activities:**

Prior to administering the final performance task, “Chris’ Garden Dilemma”, students should have completed the initial assessment “Penny’s Patchwork Quilt” and the formative assessment “Mr. Buckle’s Bulletin Boards”. For additional support, teachers may use any of the tasks or games referenced in Instructional Resources. These are pre-assessment activities to help students develop problem-solving and computational strategies for solving multi-step problems using addition and multiplication. These pre-assessment activities allow students to construct and explain their understanding of the relationship between area and perimeter. These activities provide multiple opportunities for students to participate in rich mathematical conversations between students (Number Talks).

**What the task accomplishes:**

This task directly addresses the concepts of area and perimeter. Students will use what they have learned and demonstrate their understanding by applying it to a real-world situation.

**Implementation Notes:**

- ✓ This mathematics performance assessment is not designed to be a reading test. When implementing the task, teachers might need to read the task orally to their students, and make sure that all students are clear on what the task is asking and answer questions that students may have. Teachers should not lead the students to a specific strategy or solution.
- ✓ Students may use manipulatives to solve the problem.
- ✓ Students should not be limited by the amount of space provided on the page of the task to complete the performance assessment. Allow students to have additional plain and grid paper to solve the task if necessary.
- ✓ Although a recommended time is given for this assessment, it is untimed and teachers should allow students as much time as needed to complete the task within a reasonable amount time.



## GRADE 3 MATH: CHRIS' GARDEN DILEMMA

### RUBRIC

The rubric section contains a teacher rubric, scoring guide, answer key, and student rubric with performance-level descriptions for the Chris' Garden Dilemma task.

**Scoring Guide:** The scoring guide is designed to analyze students' work. It allows the teacher to identify common misunderstandings students may have about the task. The scoring guide can be used to refer back to the performance-level descriptions that identify the implications for instruction.

**Performance-Level Descriptions:** Performance-level descriptions help teachers think about the overall quality of work for each task by providing information about the expected level of performance for students. Performance-level descriptions provide score ranges for each level, which are assessed using the scoring guide.

# Grade 3 Math: Chris' Garden Dilemma

## Performance Task Rubric

### Performance-Level Description and Cut Scores

Performance is reported at four levels, 1 through 4, with 4 as the highest.

#### Level 1: Demonstrates Minimal Success (0–2 points)

The student's response demonstrates *few elements* of performance that the task demands as defined by the Common Core standards. The work shows a minimal attempt to make sense of the problem and persevere in solving it. The student lacks a concrete understanding of how to construct and calculate the area and perimeter of a shape based on the measurements provided. Communication is limited and shows minimal reasoning. The student struggles to recognize relationships or the structure of the problem. The misconceptions about area and perimeter suggest that the student would not be able to produce high-quality solutions without significant further instruction and support.

#### Level 2: Performance Approaching Standard (3–5 points)

The student's response shows *some elements* of performance that the task demands as defined by the Common Core standards. A student at this level struggles with making sense of the problem. The student confuses perimeter and area, and units of measurement are either omitted or incorrect. The student's reasoning is inconsistent with work shown. The student gives unsound mathematical reasoning to support his/her explanations.

#### Level 3: Performance at Standard (6–8 points)

The student's response shows understanding of the *major elements* of performance that the task demands as defined by the Common Core standards. The student may have few errors in computation or measurement, but demonstrates a clear understanding of perimeter and area. A student at this level attends to precision in accurately drawing, labeling, and using the appropriate units of measurement. The student is able to give an explanation and/or reasoning of how he/she arrived at his/her answer using key vocabulary.

#### Level 4: Achieve Performance at High Standards (9–10 points)

The student's response shows *mastery of elements* of performance that the task demands as defined by the Common Core standards. The student shows good understanding of perimeter and area. There are few or no errors in computation or measurement, and units are used correctly. The student's work provides a clear and detailed explanation of how he/she arrived at his/her answers. The student's response justifies his/her mathematical thinking in the context of the situation and reflects on whether the results make sense.

# **Grade 3: Chris' Garden Dilemma**

## Performance Task Scoring Guide





The core elements of performance required by this task are:

- Work with area and perimeter in a real-world context
- Use tiling or multiplication strategies to find the area of rectangles
- Use addition or multiplication strategies to calculate the perimeter of rectangles

Based on the criteria below, the following points will be given.

Common Core Standards	Answer Elements Per Question	Points	Section Points
<p><b>3.MD.5:</b> Recognize area as an attribute of plane figures and understand concepts of area measurement.</p> <p>a. A square with side length of one unit, called a “unit square”, is said to have “one square unit” of area, and can be used to measure area.</p> <p>b. A plane figure which can be covered without gaps or overlaps by <math>n</math> unit squares is said to have an area of <math>n</math> unit squares.</p> <p><b>3.MD.6:</b> Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units)</p> <p><b>3.MD.8:</b> Solve real-world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.</p>	<p><b>Question 1</b></p> <p>Draws the yard</p> <p>Labels the yard with the length and width</p>	<p>1</p> <p>1</p>	<p><b>2</b></p>
<p><b>3.MD.8:</b> Solve real-world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.</p>	<p><b>Question 2</b></p> <p>Sets up the correct equation for perimeter</p> <p>Gives correct answer and uses the correct unit of measurement</p>	<p>1</p> <p>1</p>	<p><b>2</b></p>
<p><b>3.MD.6:</b> Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units)</p> <p><b>3.MD.7:</b> Relate area to the operations of multiplication and addition.</p> <p>a. Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths.</p> <p>b. Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real-world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning.</p> <p><b>3.MD.8:</b> Solve real-world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.</p>	<p><b>Question 3a</b></p> <p>Draws and labels length of width of <b>two</b> different gardens with a perimeter of 24 (one point is given for each garden)</p> <p>Computes the area of the <b>two</b> different rectangles and labels square units (one point is given for each garden)</p>	<p>2</p> <p>2</p>	<p><b>4</b></p>
<p><b>3.MD.7:</b> Relate area to the operations of multiplication and addition.</p> <p>a. Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths.</p> <p>b. Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real-world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning.</p> <p><b>3.MD.8:</b> Solve real-world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.</p>	<p><b>Question 3b</b></p> <p>Provides an explanation that shows sufficient reasoning for his/her choice</p> <p>Uses appropriate mathematical language in his/her response</p>	<p>1</p> <p>1</p>	<p><b>2</b></p>
<b>Total Points</b>		<b>10</b>	

**Grade 3 Math: Chris' Garden Dilemma**  
**Student Performance Task Rubric**

Performance Levels	Strategies, Reasoning, and Procedures
<p>Level 1</p> 	<p>You attempted the task, but your responses indicate that you need <b>further instruction</b> on area and perimeter.</p>
<p>Level 2</p> 	<p>You began to explain your thinking/reasoning, indicating that you <b>understand some elements</b> of the task. However, you rarely used the appropriate math language, which is why your explanations were incomplete or difficult to follow.</p>
<p>Level 3</p> 	<p>You <b>understand the major elements</b> of the task.  Your work is mainly or completely accurate, and is labeled with the appropriate units of measurement.</p>
<p>Level 4</p> 	<p>Your work shows that you have a good understanding of perimeter and area. You have <b>mastered</b> the elements of the task, although you may have made minor errors in computation or measurement.  Your responses demonstrate your mathematical thinking, and shows that you can apply what you know to a real-life situation.</p>



## GRADE 3 MATH: CHRIS' GARDEN DILEMMA

### ANNOTATED STUDENT WORK

This section contains annotated student work at a range of score points and implications for instruction for each performance level. The student work shows examples of student understandings and misunderstandings of the task which can be used to support students in moving to the next performance level.

## GRADE 3: CHRIS' GARDEN DILEMMA

### Annotated Student Work

#### Level 4: Achieves Standards at a High Level (Score Range 9–10)

The student's response shows *mastery of elements* of performance that the task demands as defined by the Common Core standards. The student shows good understanding of perimeter and area. There are few or no errors in computation or measurement, and units are used correctly. The student's work provides a clear and detailed explanation of how they arrived at their answers. The student's response justifies his/her mathematical thinking in the context of the situation and reflects on whether the results make sense.

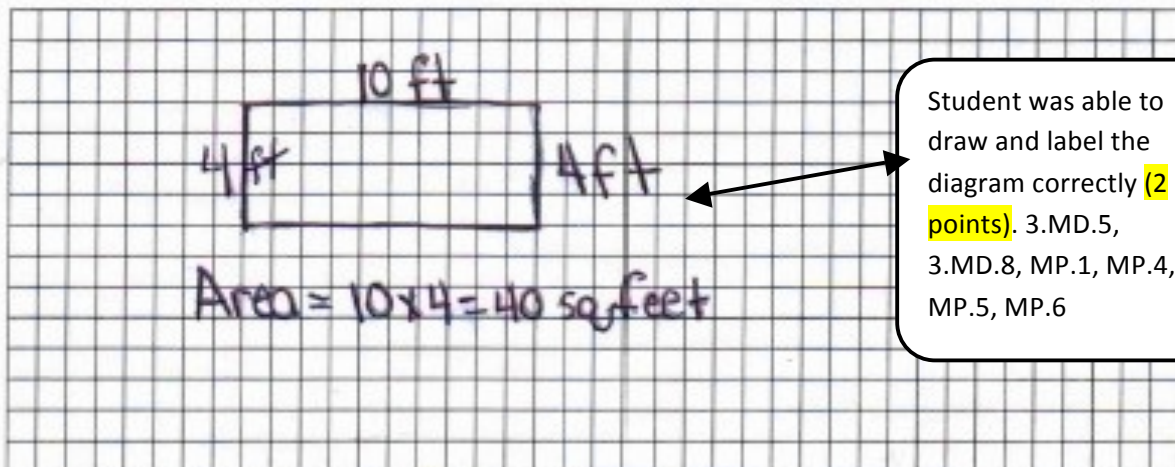
#### STUDENT A – Level: 4 Points: 10



#### Task: Chris' Garden Dilemma

Chris has a rectangular yard that covers an area of 40 square feet.

1. Draw the yard and label the length and the width.



Student was able to draw and label the diagram correctly (2 points). 3.MD.5, 3.MD.8, MP.1, MP.4, MP.5, MP.6

2. Chris is not sure about how many feet of fencing he will need, for the outside of the yard.

Write an equation that shows how to solve the problem?

Equation:  $4 + 4 + 10 + 10 = 28 \text{ feet}$

How many feet of fencing would he need? 28

Student set up and solved the mathematical equation using the appropriate unit of measurement (2 points). 3.MD.8, MP.2, MP.6



## GRADE 3: CHRIS' GARDEN DILEMMA

### Annotated Student Work

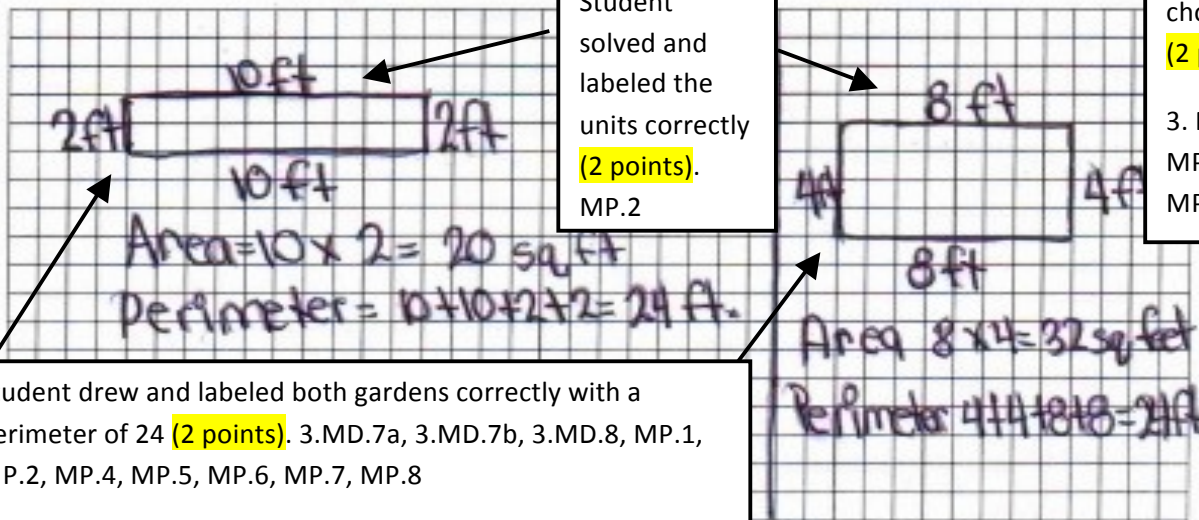
3a. Chris wants to create a rectangular rose garden in the yard. He has 24 feet of garden fencing.

Show Chris **two** different ways he could construct the garden with different measurements of area.

Draw and label each garden including the area.

Garden 1 Area: 20 sq ft

Garden 2 Area: 32 sq ft



Student drew and labeled both gardens correctly with a perimeter of 24 (2 points). 3.MD.7a, 3.MD.7b, 3.MD.8, MP.1, MP.2, MP.4, MP.5, MP.6, MP.7, MP.8

Student was able to provide a reasonable and accurate explanation using mathematical language to support the choice of garden (2 points).

3. MD.7, 3.MD.8, MP.1, MP.2, MP.3

3b. Which garden would you recommend that Chris choose? Explain your answer.

The garden I recommend Chris would pick is Garden 2. I say that because garden 2 has more width than garden 1. Also garden 1 may be long but you wouldn't have a lot of space to let the plants expand like garden 2. That's why I recommend Chris should choose Garden 2.

#### Level 4 Implications for Instruction

Students at this level would benefit from opportunities to develop their understanding of area and perimeter by measuring more complex polygons. Provide students opportunities to explore 4th-grade content such as 4.MD.3: "Apply the area and perimeter formulas for rectangles in real-world and mathematical problems." Students at this level should have opportunities to deepen their understanding through questioning and critiquing the reasoning of others in class discussions or group activities.



# GRADE 3: CHRIS' GARDEN DILEMMA

## Annotated Student Work

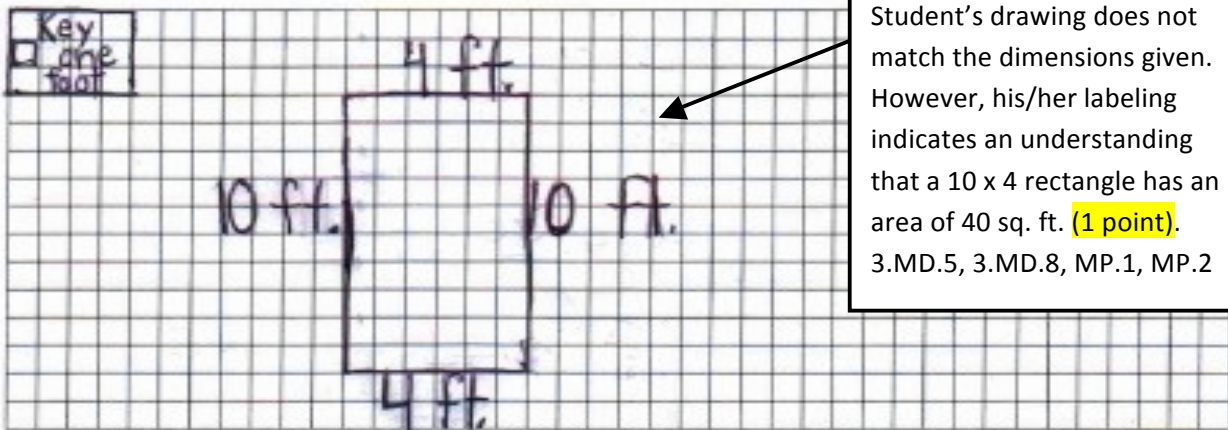
STUDENT B – Level: 3 Points: 8



### Task: Chris' Garden Dilemma

Chris has a rectangular yard that covers an area of 40 square feet.

1. Draw the yard and label the length and the width.



Student's drawing does not match the dimensions given. However, his/her labeling indicates an understanding that a 10 x 4 rectangle has an area of 40 sq. ft. (1 point). 3.MD.5, 3.MD.8, MP.1, MP.2

2. Chris is not sure about how many feet of fencing he will need for the outside of the yard.

Write an equation that shows how to solve the problem.

Equation:  $10 + 10 + 4 + 4 = 28$

How many feet of fencing would he need? 28 feet

Student set up (1 point) and solved the equation correctly with the correct unit of measurement (1 point). MP.1, MP.2, 3.MD.8

## GRADE 3: CHRIS' GARDEN DILEMMA

### Annotated Student Work

3a. Chris wants to create a rectangular rose garden in the yard. He has 24 feet of garden fencing.

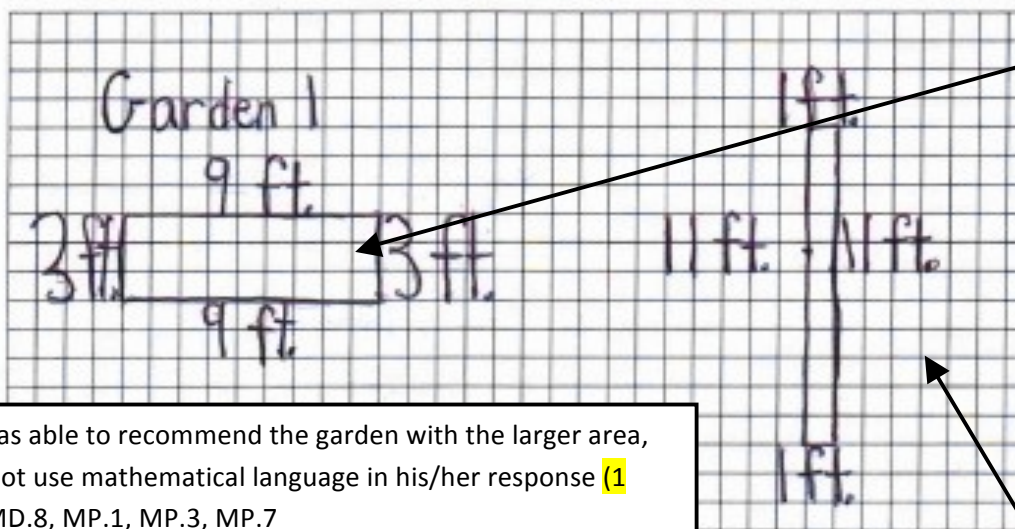
Show Chris **two** different gardens with different measurements.

The correct area is shown for both gardens with correct units of measurement (2 points). 3.MD.7, MP.1

Draw and label each garden including the area.

Garden 1 Area: 27 square ft

Garden 2 Area: 11 square ft



Student was able to recommend the garden with the larger area, but does not use mathematical language in his/her response (1 point). 3.MD.8, MP.1, MP.3, MP.7

Student was able to draw and label two different gardens with a perimeter of 24 ft. (2 points). Student understood how to find the area by counting the unit squares of each garden. Student labeled the area with the correct measurement. 3.MD.7a, 3.MD.7b, 3.MD.8, MP.1, MP.2, MP.6

3b. Which garden would you recommend that Chris choose? Explain your answer.

I would recommend Garden 1. This is because Garden 2 is too thin.

### Level 3 Implications for Instruction

Students at this level may make minor errors when calculating the area and perimeter of a rectangle. For example, students may need to use a problem-solving recording sheet or checklist. They demonstrate understanding of the concepts of area and perimeter and can apply that understanding to solve a real-world problem. Students at this level need more opportunities to articulate their reasoning through activities such as modeling, critiquing the reasoning of others, and being encouraged to assess their own thinking.

## GRADE 3: CHRIS' GARDEN DILEMMA

### Annotated Student Work

#### Level 3: Performance at Standard (Score Range 6–8)

The student's response shows understanding of the *major elements* of performance that the task demands as defined by the Common Core standards. The student may have few errors in computation or measurement, but demonstrates a clear understanding of perimeter and area. A student at this level attends to precision in accurately drawing, labeling, and using the appropriate units of measurement. The student is able to give an explanation and/or reasoning of how he/she arrived at his/her answer using key vocabulary.

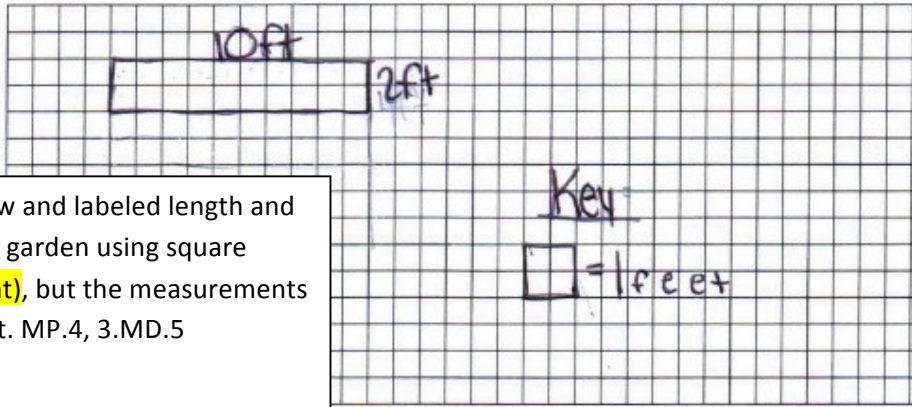
#### STUDENT C – Level: 3 Points: 7



#### Task: Chris' Garden Dilemma

Chris has a rectangular yard that covers an area of 40 square feet.

1. Draw the yard and label the length and the width.



Student drew and labeled length and width of the garden using square units (1 point), but the measurements are incorrect. MP.4, 3.MD.5

Based on the measurements, student was able to write and solve an equation for perimeter (1 point), but incorrectly labeled the unit of measure.

3.MD.8, MP.1, MP.2, MP.6

2. Chris is not sure about how many feet of fencing he will need, for the outside of the yard.

Write an equation that shows how to solve the problem?

Equation:  $10 + 10 + 2 + 2 = 24$  feet

How many feet of fencing would he need?  $24$  square feet



## GRADE 3: CHRIS' GARDEN DILEMMA

### Annotated Student Work

- 3a. Chris wants to create a rectangular rose garden in the yard. He has 24 feet of garden fencing.

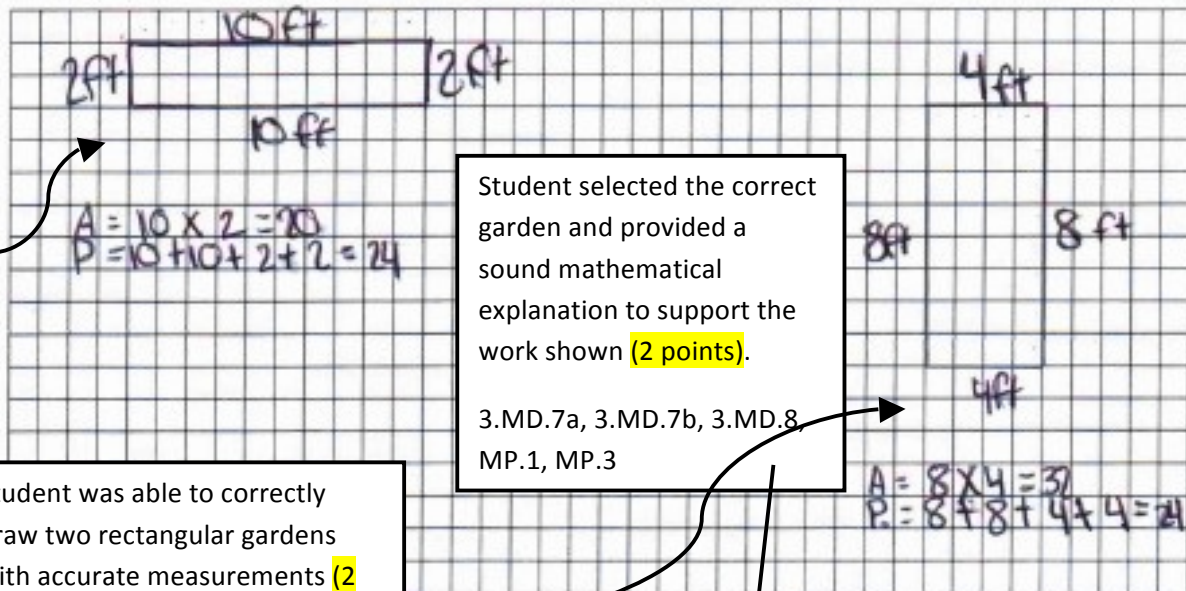
Show Chris **two** different ways he could construct the garden with different measurements of area.

Draw and label each garden including the area.

Student computed the area for each garden accurately, but only labeled one of the gardens with the correct square units (1 point). 3.MD.7, 3.MD.8, MP.1, MP.6

Garden 1 Area: 20

Garden 2 Area: 32 sq ft



Student was able to correctly draw two rectangular gardens with accurate measurements (2 points). MP.2, MP.6, MP.7, MP.8

Student selected the correct garden and provided a sound mathematical explanation to support the work shown (2 points).

3.MD.7a, 3.MD.7b, 3.MD.8, MP.1, MP.3

- 3b. Which garden would you recommend that Chris choose? Explain your answer.

Chris should choose garden 2 because garden two has a lot of space to plant a garden that garden 1.

#### Level 3 Implications for Instruction

Student demonstrates slight evidence of misunderstanding of area, as evidenced in Question 1, but clearly an understanding of area in Question 3a; therefore, further instruction is required in interpreting what the question is actually asking the student to do. Think-Pair-Share strategy will help students organize their ideas. Students at this level will demonstrate understanding of the concepts of area and perimeter and demonstrate application of that understanding to solve a real-world problem.

# **GRADE 3: CHRIS' GARDEN DILEMMA** **Annotated Student Work**

STUDENT D – Level: 2 Points: 3

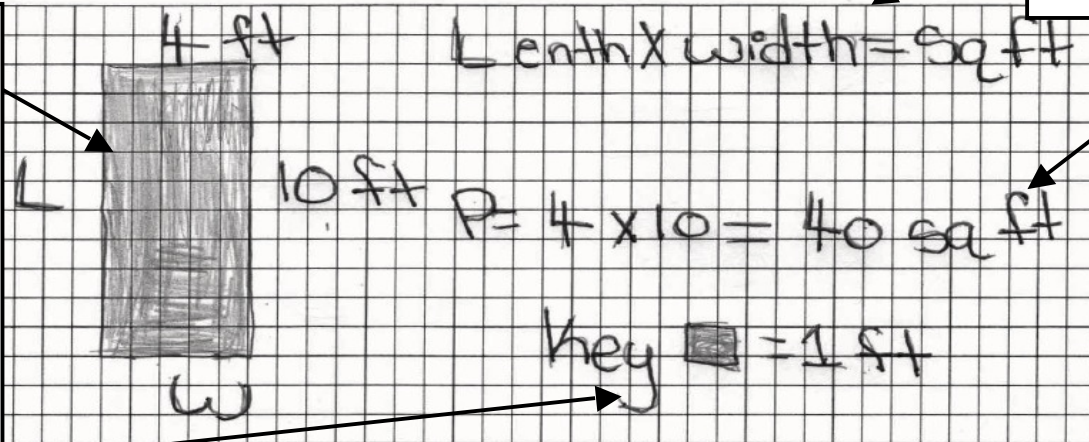


## **Task: Chris' Garden Dilemma**

Chris has a rectangular yard that covers an area of 40 square feet.

1. Draw the yard and label the length and the width.

Student drew a rectangle (1 point) with the correct measurements (1 point). The key was inaccurate. MP.1, MP.4, MP.5, 3.MD.6



Student applied the formula for area, but incorrectly labeled the equation. 3.MD.5, 3.MD.8, MP.1, MP.2, MP.6

2. Chris is not sure about how many feet of fencing he will need, for the outside of the yard.

Write an equation that shows how to solve the problem?

Equation:  $10 + 10 + 4 + 4 = 28 \text{ sq ft}$

How many feet of fencing would he need? 28 sq ft feet

Student correctly set up the equation the perimeter of the garden (1 point), but labeled the perimeter with the incorrect unit of measure. 3.MD.8, MP.2, MP.6

## GRADE 3: CHRIS' GARDEN DILEMMA

### Annotated Student Work

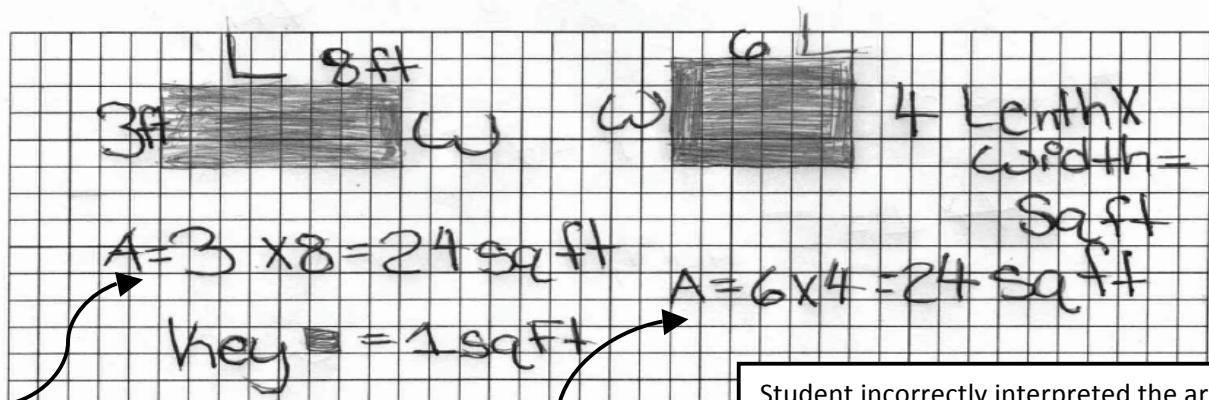
- 3a. Chris wants to create a rectangular rose garden in the yard. He has 24 feet of garden fencing.

Show Chris **two** different ways he could construct the garden with different measurements of area.

Draw and label each garden including the area.

Student labeled the area with feet rather than square feet. MP.6

Garden 1 Area:  $3 \times 8 = 24 \text{ ft}$       Garden 2 Area:  $4 \times 6 = 24 \text{ ft}$



Student incorrectly formed two rectangles with areas of 24 sq. ft. instead of a perimeter of 24 ft. MP.1, MP.2, 3.MD.6

Student incorrectly interpreted the areas of the two shapes as being different, although they both have the same number of square feet. 3.MD.7, 3.MD.8, MP.3, MP.5

- 3b. Which garden would you recommend that Chris choose? Explain your answer.

I would recommend that Chris garden  $A = 3 \times 8 = 24 \text{ sq ft}$ . Because he can plant more roses.

#### Level 2 Implications for Instruction

Student is not able to distinguish between area and perimeter. These students would benefit from more practice in using multiplication and addition strategies. Allow students to explore the relationship between perimeter and area by drawing rectangles on grid paper, by using square tiles, and consulting technology such as [www.mathplayground.com](http://www.mathplayground.com), [www.shodor.org/interactivate/activities](http://www.shodor.org/interactivate/activities), or [www.funbrain.com](http://www.funbrain.com). This student gives unsound mathematical reasoning to support his/her explanations. Further support in providing viable arguments to justify their answers is needed. Giving students opportunities to describe the steps they used to solve similar tasks will benefit. Also, Think-Pair-Share strategy will help students organize their ideas. Students at this level may need additional instruction on how to check their work for precision.



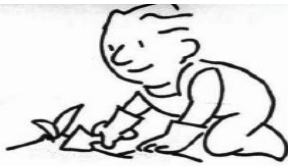
## GRADE 3: CHRIS' GARDEN DILEMMA

### Annotated Student Work

#### Level 1: Demonstrates Minimal Success (Score Range 0–2)

The student's response demonstrates few elements of performance that the task demands as defined by the Common Core standards. The work shows a minimal attempt to make sense of the problem and persevere in solving it. The student lacks a concrete understanding of how to construct and calculate the area and perimeter of a shape based on the measurements provided. Communication is limited and shows minimal reasoning. The student struggles to recognize relationships or the structure of the problem. The misconceptions about area and perimeter suggest that the student would not be able to produce high-quality solutions without significant further instruction and support.

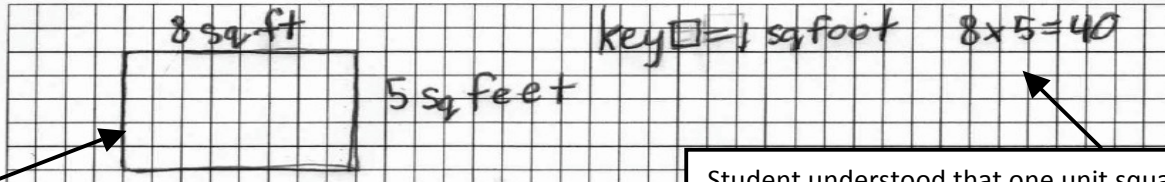
#### STUDENT E – Level: 1 Points: 1



#### Task: Chris' Garden Dilemma

Chris has a rectangular yard that covers an area of 40 square feet.

1. Draw the yard and label the length and the width.



**1 point** was given for drawing garden: Student was able to create a rectangle with an area of 40 sq. ft., but incorrectly labeled the length and width using sq. ft. instead of feet. MP.4, 3.MD.5, 3.MD.8

Student understood that one unit square is equal to one square foot. Also, student strategically used graph paper as a tool to perform the task. 3.MD.5.a, 3.MD.6, 3.MD.8, MP.2, MP.4, MP.5

Write an equation that shows how to solve the problem?

Equation:  $8 \times 5 = 40$

How many feet of fencing would he need? 40 feet

Student incorrectly applied the formula for area when asked to calculate the perimeter. Student did not attend to precision or reason abstractly and quantitatively to provide a correct solution. MP.2, MP.6

## GRADE 3: CHRIS' GARDEN DILEMMA

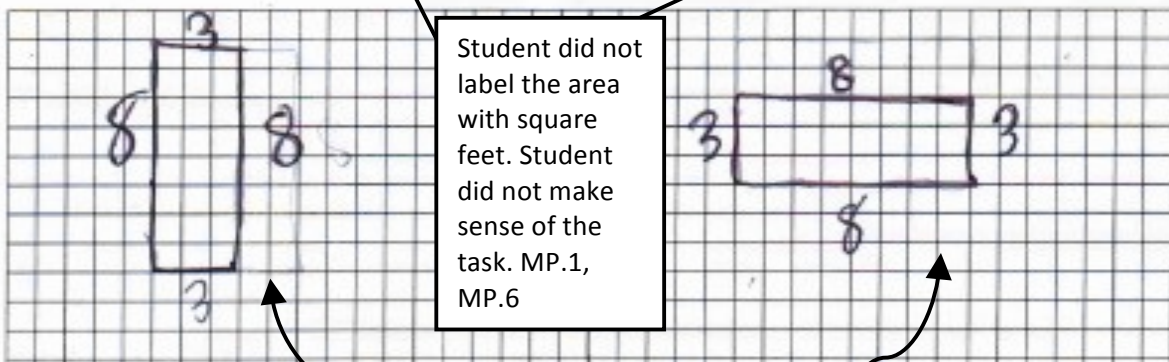
### Annotated Student Work

- 3a. Chris wants to create a rectangular rose garden in the yard. He has 24 feet of garden fencing.

Show Chris **two** different ways he could construct the garden with different measurements of area.

Draw and label each garden including the area.

Garden 1 Area: 24      Garden 2 Area: 24



Student was able to draw two rectangles; however, the rectangles have the same dimensions and do not have a perimeter of 24 feet. Student did not label the sides of the rectangle with the correct unit. 3.MD.7a, 3.MD.7b, MP.2, MP.7

- 3b. Which garden would you recommend that Chris choose your answer.

Student did not support his/her choice with mathematical reasoning. MP.3

I would recommend garden 2 because I think it has perfect shape and size. I think Chris would love his new garden a lot.

#### Level 1 Implications for Instruction

Student needs support with attending to precision in labeling the measurements for the perimeter using linear units and for the area using square units. Students at this level may need more support with looking for and making use of structure by relating the array model to multiplication or by counting the number of square units in a region. To support students in understanding the concept of perimeter and area, allow them to use grid paper. Students need more opportunities to construct viable arguments and justify their reasoning. Key concepts can be reinforced by building mathematical vocabulary, utilizing Number Talks, Exit Slips, or Math Journal for students to reflect on their thinking. Students at this level need more concrete instruction that focuses on the concepts of perimeter and area, such as using wiki sticks, highlighted outlines, strings, straws, unit cubes, and tiles.



# Mathematics



## GRADE 3 MATH: CHRIS' GARDEN DILEMMA

### INSTRUCTIONAL SUPPORTS

The instructional supports on the following pages include a unit outline with initial and formative assessments as well as suggested learning activities. Teachers may use this unit outline as it is described, integrate parts of it into a currently existing curriculum unit, or use it as a model or checklist for a currently existing unit on a different topic.

# Unit Outline

**INTRODUCTION:** This unit outline provides an example of how to integrate performance tasks into a unit. *Teachers may (a) use this unit outline as it is described below; (b) integrate parts of it into a currently existing curriculum unit; or (c) use it as a model or checklist for a currently existing unit on a different topic. The length of the unit includes suggested time spent on the classroom instruction of lessons and administration of assessments. Please note that this framework does not include individual lessons.*

## Grade 3 Math: Chris' Garden Dilemma

### UNIT TOPIC AND LENGTH:

- This unit focuses on geometric measurement:
  - perimeter
  - area
- This unit will be integrated into an existing math curriculum
- Timeline: approximately 4 weeks

### COMMON CORE LEARNING STANDARDS:

- 3.MD.5: Recognize area as attribute of plane figures and understand concepts of area measurement.
  - a. A square with side length of one unit, called a “unit square”, is said to have “one square unit” of area, and can be used to measure area.
  - b. A plane figure which can be covered without gaps or overlaps by  $n$  unit squares is said to have an area of  $n$  square units.
- 3.MD.6: Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).
- 3.MD.7: Relate area to the operations of multiplication and addition.
  - a. Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths.
  - b. Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real-world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning.
- 3.MD.8: Solve real-world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.

### MATHEMATICAL PRACTICES:

- MP.1 Make sense of problems and persevere in solving them.
- MP.2 Reason abstractly and quantitatively.
- MP.3 Construct viable arguments and critique the reasoning of others.
- MP.4 Model with mathematics.
- MP.5 Use appropriate tools strategically.
- MP.6 Attend to precision.
- MP.7 Look for and make use of structure.
- MP.8 Look for and express regularity in repeated reasoning.

<p><b>BIG IDEAS/ENDURING UNDERSTANDINGS:</b> Students will understand:</p> <ul style="list-style-type: none"><li>➤ That the distance around a figure is its perimeter.</li><li>➤ How to choose appropriate tools for measuring the perimeter of plane figures.</li><li>➤ How to measure the amount of space inside a region (area).</li><li>➤ The relationship between perimeter and area of rectangles.</li><li>➤ That shapes can have the same perimeter and different areas, or the same area and different perimeters.</li><li>➤ How to solve real-world problems involving area and perimeter.</li></ul>	<p><b>ESSENTIAL QUESTIONS:</b></p> <ul style="list-style-type: none"><li>➤ Arc of Learning #1: How do you find the perimeter of polygons with known and unknown sides in real-world situations?</li><li>➤ Arc of Learning #2: How do you find the area of rectangles in real-world situations?</li><li>➤ Arc of Learning #3: How are perimeter and area related to one another? Can two figures have the same area and different perimeters? Can two figures have the same perimeter and different areas?</li></ul>																																
<p><b>CONTENT:</b></p> <ul style="list-style-type: none"><li>➤ The big idea of this unit is to understand perimeter and area and how to apply this understanding to real-world situations.</li><li>➤ The understanding of perimeter includes the ability to add the lengths of the sides of polygons, as well as using a mathematic equation for finding the perimeters of regular polygons.</li><li>➤ The understanding of area includes the ability to find the total number of square units needed to cover a rectangle. This can be done by using multiplication or counting square units.</li></ul>	<p><b>SKILLS:</b></p> <ul style="list-style-type: none"><li>➤ Students apply what they know about the meaning of multiplication and addition to generate visual, verbal, and numerical representations.</li><li>➤ Students apply their new knowledge to construct arguments and make connections between representations.</li><li>➤ Students will be able to show their reasoning and understandings through various visual representations and verbal descriptions.</li></ul>																																
<p><b>VOCABULARY/KEY TERMS:</b></p> <table><tr><td>Scale</td><td>Array</td><td>Pattern</td><td>Fencing</td></tr><tr><td>Perimeter</td><td>Area</td><td>Square unit</td><td>Customary</td></tr><tr><td>Plane figure</td><td>Square centimeters</td><td>Square inches</td><td>Metric</td></tr><tr><td>Square feet</td><td>Square meters</td><td>Polygon</td><td>Feet</td></tr><tr><td>Linear</td><td>Length</td><td>Width</td><td>Centimeters</td></tr><tr><td>Equation</td><td>Tiling</td><td>Tessellations</td><td>Properties</td></tr><tr><td>Inches</td><td>Unit Squares</td><td>Distance</td><td>Attributes</td></tr><tr><td>Square</td><td>Rectangle</td><td>Space/Region</td><td></td></tr></table>		Scale	Array	Pattern	Fencing	Perimeter	Area	Square unit	Customary	Plane figure	Square centimeters	Square inches	Metric	Square feet	Square meters	Polygon	Feet	Linear	Length	Width	Centimeters	Equation	Tiling	Tessellations	Properties	Inches	Unit Squares	Distance	Attributes	Square	Rectangle	Space/Region	
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**ASSESSMENT EVIDENCE AND ACTIVITIES:**

This unit is designed with a pre-assessment task, formative assessment, and a final performance assessment. The mathematics of the unit involves understanding perimeter and area, as well as applying these concepts to real-world problems. Students will work with perimeter and area using equations, mathematical language, area models, discrete representations, and contextualized word problems to think about the relationship between area and perimeter. Also included are teacher notes, rubrics, and annotated student work with comments. This unit is designed to accompany the curriculum a teacher currently uses to teach the topics listed. The elements in this unit will provide activities to foster formative assessment practices, conceptual understanding, and non-routine problem solving.

**INITIAL ASSESSMENT:**

This unit begins with the performance task “Penny’s Patchwork Quilt”. The task is designed to see what knowledge and skills students bring to the unit. Please reference “Penny’s Patchwork Quilt” for the full details.

**FORMATIVE ASSESSMENT:**

About two-thirds of the way through the unit, teachers should use the formative assessment lesson (FAL) entitled “Mr. Buckle’s Bulletin Boards”. Students should spend no more than 45 minutes completing this task independently. Teachers review student work prior to teaching follow-up lessons to address any misunderstandings students may have with perimeter and area. The FAL comes with teacher notes and the student page. Please reference “Mr. Buckle’s Bulletin Boards” for full details.

**FINAL PERFORMANCE TASK:**

The final performance assessment is entitled “Chris’ Garden Dilemma”. It should be administered during a class period. The students should be allowed to use any tools or materials necessary for this task. The task can be read to the students and all accommodations delineated in IEPs should be followed. The task has a specific rubric and a scoring guide with annotated student work. Please reference “Chris’ Garden Dilemma” for full details.

**ARCS OF LEARNING:**

\*The initial assessment entitled “Penny’s Patchwork Quilt” should be administered at the start of the instructional unit.

**Arc of Learning #1: Introduction to Geometric Measurement – Perimeter**

*Essential Question: How do you find the perimeter of polygons with known and unknown sides in real-world situations?*

- In week one of the unit, students will draw rectangular shapes of various sizes and use rulers, yardsticks, and/or measuring tape to measure the side lengths of polygons. After using tools strategically, students will practice adding all the side lengths to calculate the perimeter. Students will practice drawing shapes on grid paper and accurately write an equation to calculate the perimeter of a shape. Also, students will pay attention to labeling perimeter in linear units such as inches, feet, and meters. Finally, students will work to determine perimeter of polygons with unknown side lengths.

- To address common misunderstandings, teachers can supplement this arc with the following intervention supports:
  - Rulers Rule!
  - Using Measurement Tools Strategically
  - Cheez-It Up (Perimeter)

## **Arc of Learning #2: Introduction to Geometric Measurement – Area**

*Essential Question: How do you find the area of rectangles in real-world situations?*

- In *weeks two and three* of the unit, students will recognize area as an attribute of plane figures. Students will practice counting square units as well as multiplying side lengths to determine the area. Students will practice drawing shapes on grid paper and accurately write an equation to calculate the area of a shape. Also, students will pay attention to labeling area in square units such as square inches, square feet, and square meters. Students will apply what they know about the meaning of multiplication and addition to generate visual, verbal, and numerical representations.
- Teachers can reference instructional resources and use the following tasks to support the Common Core standards addressed in this Arc of Learning:
  - Task: Exploring Area
  - Task: Area on the Geoboard
  - Task: Comparing Rectangles
  - Task: Developing a Formula for the Area of a Rectangle
- To address common misunderstandings, teachers can supplement this arc with the following intervention supports:
  - Cheez-It Up (Area)
  - The Area of it All
  - Stitching it All Together (Part I only)

\*The formative assessment entitled “Mr. Buckle’s Bulletin Boards” should be administered at the completion of Arc of Learning #2.

## **Arc of Learning #3: Solving Different Perimeters and Areas**

*Essential Questions: How are perimeter and area related to one another? Can two figures have the same area and different perimeters? Can two figures have the same perimeter and different areas?*

- In *week four* of the unit, students will explore the relationship between area and perimeter by understanding that rectangles can have the same perimeter but different areas, or the same area and different perimeters. Students will utilize opportunities to apply their understanding of area and perimeter to explain and provide evidence to support their reasoning, whether it is stated verbally or written.
- Teachers can reference Instructional Resources and use the following tasks to support the Common Core standards addressed in this Arc of Learning:
  - Task: Rectangles with Color Tiles
  - Task: Constructing a Rabbit Enclosure
  - Task: Perimeter Stays the Same
  - Task: Area Stays the Same
- To address common misunderstandings, teachers can supplement this arc with the following intervention supports:
  - Will We All Fit?
  - Stitching it All Together (Part II)

\*The final Performance Task entitled “Chris’ Garden Dilemma” should be administered at the completion of Arc of Learning #3.

## Opportunities for Re-engagement

The unit begins with a pre-assessment called “Penny’s Patchwork Quilt”. The teacher’s analysis of students’ work will provide integral information in determining how to proceed with future lessons. The process called “re-engagement” gives teachers opportunities to analyze and contrast student thinking. It also raises the cognitive demand and supports students in reflecting on their own thinking. The re-engagement lessons will vary in each individual class. Students will have the opportunity to recognize and address any misconceptions.

How to address misconceptions:

1. Start with a foundational problem to bring all the students along; this allows students to clarify and articulate important mathematics in order to better understand the entirety of the task.
2. Share different student approaches and ask all students to make sense of each strategy. Have all students compare the strategies to look for the mathematical connections and relationships.
3. Have students analyze misconceptions and discuss why they don’t make sense. In the process students can clarify their thinking about big mathematical ideas.
4. Have students determine how a strategy could be modified to get the correct solution. Have students look for the seeds of mathematical thinking in the selected student work.

➤ **Number Talks:** A daily ritual with the entire class for the purposes of developing conceptual understanding of numbers, operations, and mathematics. Number Talks are used to:

- Review and practice operations, procedures, and concepts of numbers.
  - Introduce concepts and properties of numbers.
  - Reinforce procedures and number concepts.
1. Do a number talk every day and ask questions such as:
    - How did you figure it out?
    - What did you do next?
    - Why did you do that? Tell me more.
    - Who would like to share their thinking?
    - Did someone solve it a different way?
    - Which strategies seem to be efficient, quick, and simple?
  2. Give yourself time to learn how to:
    - Record student solutions.
    - Listen to and observe students.
    - Collect notes about student strategies and understanding.
  3. Name/label the strategies that emerge from your students:
    - Use doubles
    - Break apart numbers
    - Make it simpler
    - Use a model
    - Use prior knowledge and make connections
    - Use landmark numbers
    - Think about multiples
    - Use algorithms

- **Turn and Talk and Think/Write/Pair/Share:** Strategies that respect an individual's time to process and organize ideas before engaging in peer-to-peer discussions. These processes can be used throughout the unit as a vehicle for students to self-reflect, construct new meaning by building on the ideas of others, and strengthen their arguments. Create a safe environment where students feel comfortable sharing answers. Encourage self-correction: change your mind, analyze your mistake, and try again.
- **Exit Slips and Journal Entries for Reflection:** The use of Exit Slips at the end of a lesson gives students an opportunity to reflect on their learning and is an assessment tool for teachers. Use prompts for journal entries such as, "How has my thinking changed as a result of what I have discussed with my peers?" or "How can I improve my argument or explanation using evidence and content vocabulary?" These activities can provide opportunities for students to revise their own solutions during class or for homework.
- **Purposeful Questioning and Feedback:** Instructional supports that can help refocus students' attention to specific aspects of their work and address some areas of common difficulty.

Misconceptions in the Unit	Suggested Prompts or Questions
<p>Students did not demonstrate understanding of perimeter as the measure of distance around a polygon.</p> <p>Students did not understand that all sides of a polygon must be added to find the perimeter.</p> <p>Students did not understand how to use resources provided (e.g., grid paper) to create rectangles with given dimensions.</p>	<ul style="list-style-type: none"> <li>• What are the properties of a rectangle?</li> <li>• How would you measure the distance around a rectangle?</li> <li>• How many sides must you add in order to find the perimeter of a rectangle?</li> <li>• What are you measuring when you measure the outside of a shape?</li> </ul>
<p>Many students used the incorrect procedure to find the perimeter of the quilt. They may have applied the procedure for area.</p>	<ul style="list-style-type: none"> <li>• How can you tell/show me the difference between area and perimeter?</li> <li>• If you are given the dimensions 9 feet long by 7 feet wide, does that represent <b>all</b> sides of the rectangle? Explain your reasoning.</li> </ul>
<p>There was some misunderstanding that area is the amount of space inside a region. The students did not count unit squares or multiply side lengths to determine the area of rectangles.</p>	<ul style="list-style-type: none"> <li>• What unit do we use to measure area?</li> <li>• When might you need to find the number of square units needed to cover a shape?</li> <li>• Why do you use squares instead of circles to measure area?</li> <li>• How can we measure the area of a rectangle?</li> </ul>

<p>Students had difficulty providing a clear and logical explanation in their answers.</p>	<ul style="list-style-type: none"> <li>• What sentence stems could be used to help you begin to write an explanation?</li> <li>• How could you rephrase the question in your own words?</li> <li>• What math vocabulary can you use to support your answer?</li> </ul>
<p><b><u>Additional Support Strategies:</u></b></p> <p>For students who need help understanding the concepts of perimeter and area, consider assessing and building background knowledge using the following additional support strategies:</p> <ul style="list-style-type: none"> <li>➤ Create charts and flash cards with key math vocabulary along with picture representations to build understanding of math concepts.</li> <li>➤ Use sentence frames and stems to help students express their mathematical thinking.</li> <li>➤ Provide a variety of manipulatives such as pattern blocks, geoboards, grid paper, and any other manipulatives which will give students ways to construct physical models of abstract mathematical ideas.</li> <li>➤ When introducing key mathematical concepts, the teacher may use visual and verbal representations of his/her thinking for students to follow.</li> </ul>	
<p><b><u>RESOURCES:</u></b></p> <p><b><u>Websites for Students:</u></b></p> <ul style="list-style-type: none"> <li>➤ <a href="http://beaconlearningcenter.com/WebLessons/AdamAnt/">http://beaconlearningcenter.com/WebLessons/AdamAnt/</a></li> <li>➤ <a href="http://www.mathgoodies.com/games">www.mathgoodies.com/games</a></li> <li>➤ <a href="http://www.funbrain.com/poly/index.html">www.funbrain.com/poly/index.html</a></li> </ul> <p><b><u>Websites for Teachers:</u></b></p> <ul style="list-style-type: none"> <li>➤ <a href="http://www.shodor.org/interactivate/lessons/Perimeter/">http://www.shodor.org/interactivate/lessons/Perimeter/</a></li> <li>➤ <a href="http://www.pearsonsuccessnet.com">www.pearsonsuccessnet.com</a></li> <li>➤ <a href="http://www.the-best-childrens-books.org/geometry-lesson-plans.html">www.the-best-childrens-books.org/geometry-lesson-plans.html</a></li> <li>➤ <a href="http://www.hbschool.com/glossary/math2/index3.html">www.hbschool.com/glossary/math2/index3.html</a></li> </ul> <p><b><u>Children's-Related Literature</u></b></p> <ul style="list-style-type: none"> <li>➤ Murphy, Stuart J. <i>Bigger, Better, Best (MathStart 2)</i>. New York: HarperCollins, 2002. Lexile Level: 360, Reading Level: 3.4.</li> <li>➤ Murphy, Stuart J. <i>Racing Around (MathStart 2)</i>. New York: HarperCollins, 2001. Reading Level: 2.6.</li> <li>➤ Myller, Rolf. <i>How Big Is a Foot?</i> New York: Yearling Books, 1991. Reading Level 2.0, Lexile Level: 660.</li> <li>➤ Pollack, Pam and Meg Belviso. <i>Chickens on the Move (Math Matters)</i>. New York: Kane Press, 2002. Lexile Level: 270, Reading Level: 2.3.</li> </ul> <p><b><u>Other</u></b></p> <ul style="list-style-type: none"> <li>➤ Materials used in math class include manipulatives such as array cards, square tiles, geometric pattern blocks, rulers, and grid paper.</li> <li>➤ Supplementary materials are located in the instructional resources sections.</li> </ul>	





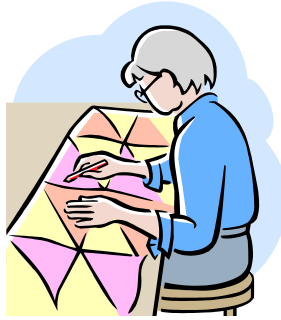
# GRADE 3 MATH: PENNY'S PATCHWORK QUILT

## INITIAL ASSESSMENT AND SCORING GUIDE

Name: \_\_\_\_\_

Date: \_\_\_\_\_

## Initial Assessment: Penny's Patchwork Quilt



**Penny is creating a patchwork quilt. Her quilt is going to be 9 feet long by 7 feet wide.**

**Show your work using numbers, drawings, or words in the work space on the next page.**

1. Penny wants to put lace around the outside edge of the quilt. How many feet of lace will she need?

**Answer:** \_\_\_\_\_

2. If Penny is using patches that measure one square foot, how many patches will she need to create the quilt?

**Answer:** \_\_\_\_\_

3a. Penny has already made another quilt that is 7 feet by 3 feet. What is the area the quilt?

**Area of quilt:** \_\_\_\_\_

3b. If Penny puts both quilts together, what would be the total area?

**Area of both quilts:** \_\_\_\_\_

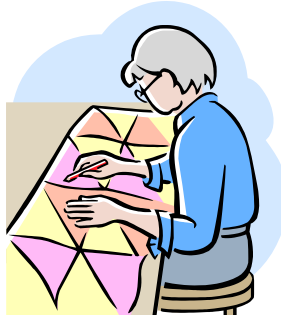
[illegible]

A large grid of graph paper with 20 columns and 12 rows. The grid is composed of small squares, with a slightly larger square in the top-left corner, likely for a title. The grid is used for drawing and graphing.

[illegible]

## ANSWER KEY

### Initial Assessment: Penny's Patchwork Quilt



**Penny is creating a patchwork quilt. Her quilt is going to be 9 feet long by 7 feet wide.**

**Show your work using numbers, drawings, or words in the work space on the next page.**

1. Penny wants to put lace around the outside edge of the quilt. How many feet of lace will she need?

**Answer:  $9 + 9 + 7 + 7 = 32 \text{ ft.}$  or  $9(2) + 7(2) = 32 \text{ ft.}$**

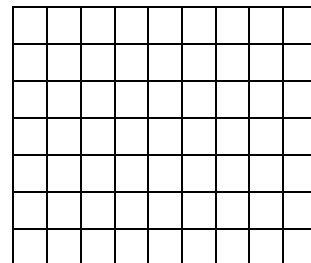
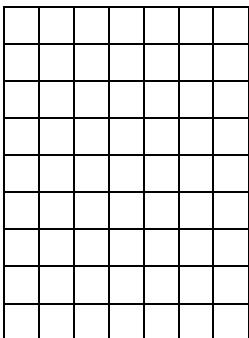
2. If Penny is using patches that measure one square foot, how many patches will she need to create the quilt?

**Answer:  $9 \times 7 = 63 \text{ sq. ft.}$  or**

**$7 \times 9 = 63 \text{ sq. ft.}$  or**

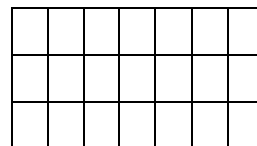
**$9+9+9+9+9+9+9=63 \text{ sq. ft.}$**

**$7+7+7+7+7+7+7+7=63 \text{ sq. ft.}$**



3a. Penny has already made another quilt that is 7 feet by 3 feet. What is the area the quilt?

**Area of quilt:  $7 \times 3 = 21$  sq. ft. or  $7 + 7 + 7 = 21$  sq. ft.**



3b. If Penny puts both quilts together, what would be the total area?

**Area of both quilts:  $63 + 21 = 84$  sq. ft.**

3c. Explain how you calculated the total area for both quilts.

**Possible explanations or any other viable arguments to justify solution:**

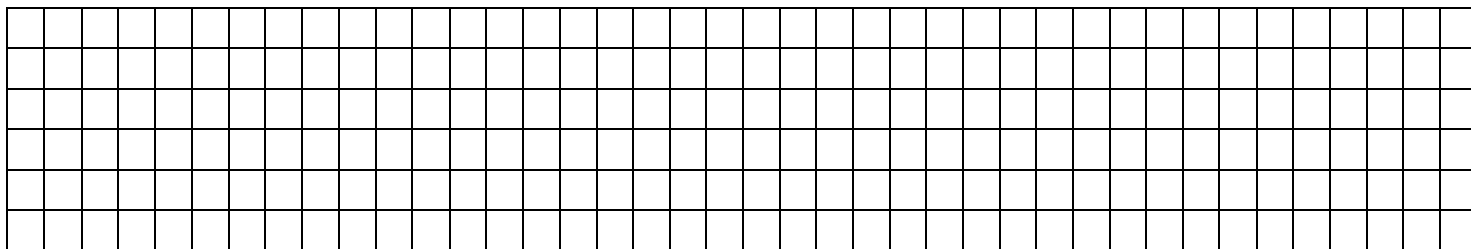
**I solved this problem by adding the areas for both quilts. I added 63 square feet plus 21 square feet and got a total area of 84 square feet.**

**or**

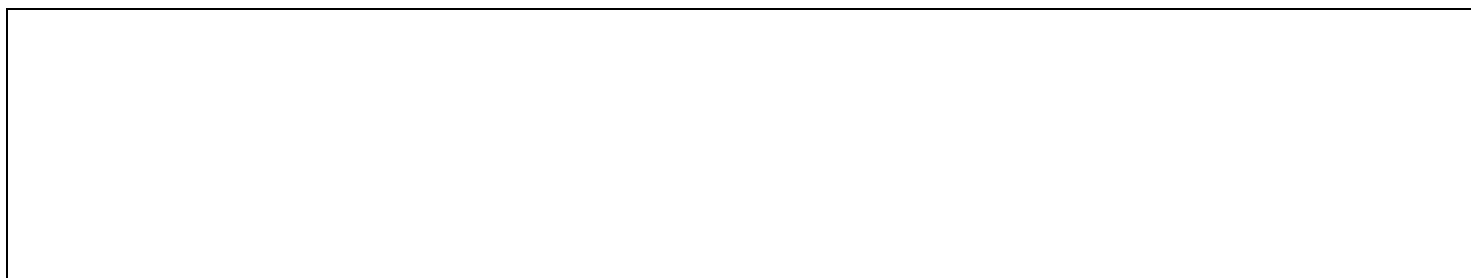
**I solved this problem by adding all of the square units from each quilt together, and received my answer of 84 square feet.**

You may choose which work space you would like to use.

**WORK SPACE**



**WORK SPACE**



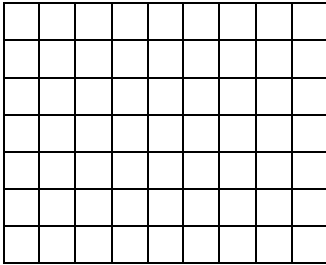
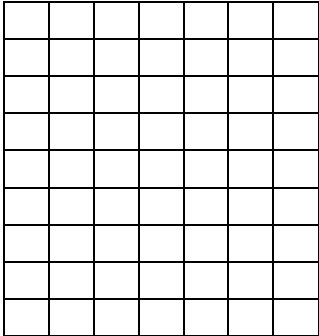
## Grade 3: Penny's Patchwork Quilt

### Performance Task Scoring Guide

The core elements of performance required by this task are:

- Work with area and perimeter in a real-world context
- Use tiling or multiplication strategies to find the area of rectangles
- Use addition or multiplication strategies to calculate the perimeter of rectangles

Based on the criteria below, the following points will be given.

Common Core Standards	Strategies and Solutions	Points	Section Points
<b>3.MD.8:</b> Solve real-world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.	<p>1. Shows equation or drawing for perimeter, such as repeated addition or <math>2(L) + 2(W)</math>.</p> <p><b>Possible solutions:</b>  <math>9(2) + 7(2) = 32</math> feet <i>or</i> <math>9+9+7+7=32</math> feet</p> <p>Uses the correct unit of measurement to label the correct answer.</p>	<p>1</p> <p>1</p>	<p>2</p>
<p><b>3.MD.6:</b> Measure area by counting unit squares (square cm, square m, square in, square ft, and improvised units).</p> <p><b>3.MD.7a:</b> Relate area to the operations of multiplication and addition.</p> <p>a. Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths.</p>	<p>2. Shows equation for area at length, width, or drawing the correct number of square units and adding them together accurately.</p> <p><b>Possible solutions:</b>  <math>7 \times 9 = 63</math> sq. ft. <i>or</i>  <math>9+9+9+9+9+9+9 = 63</math> sq. ft. <i>or</i></p>  <p><math>9 \times 7 = 63</math> sq. ft. <i>or</i></p>  <p><math>7+7+7+7+7+7+7+7 = 63</math> sq. ft.</p>	<p>1</p>	





## GRADE 3 MATH: MR. BUCKLE'S BULLETIN BOARDS

### FORMATIVE ASSESSMENT AND SCORING GUIDE



Name: \_\_\_\_\_

Date: \_\_\_\_\_

## Formative Task:

# Mr. Buckle's Bulletin Board



Mr. Buckle has a bulletin board with a length of 8 feet and a width of 4 feet.

1. Draw and label Mr. Buckle's bulletin board.

[illegible]

2. Mr. Buckle wants to put border around the outside of his bulletin board. How many feet of border will he need? **Solve** and **write** an equation that shows how many feet of border Mr. Buckle will need.

**Show your work using numbers, drawings, or words in the work space on the next page.**

**Equation:**

**Answer:**                      feet

3. How many square feet of paper will Mr. Buckle need to cover the area of the entire board?

Area of Mr. Buckle's Bulletin Board: \_\_\_\_\_

4a. Mr. Buckle has sheets of bulletin board paper that **each** has an area of 18 square feet. How many sheets of paper will he need to cover another bulletin board with an area of 36 square feet? \_\_\_\_\_

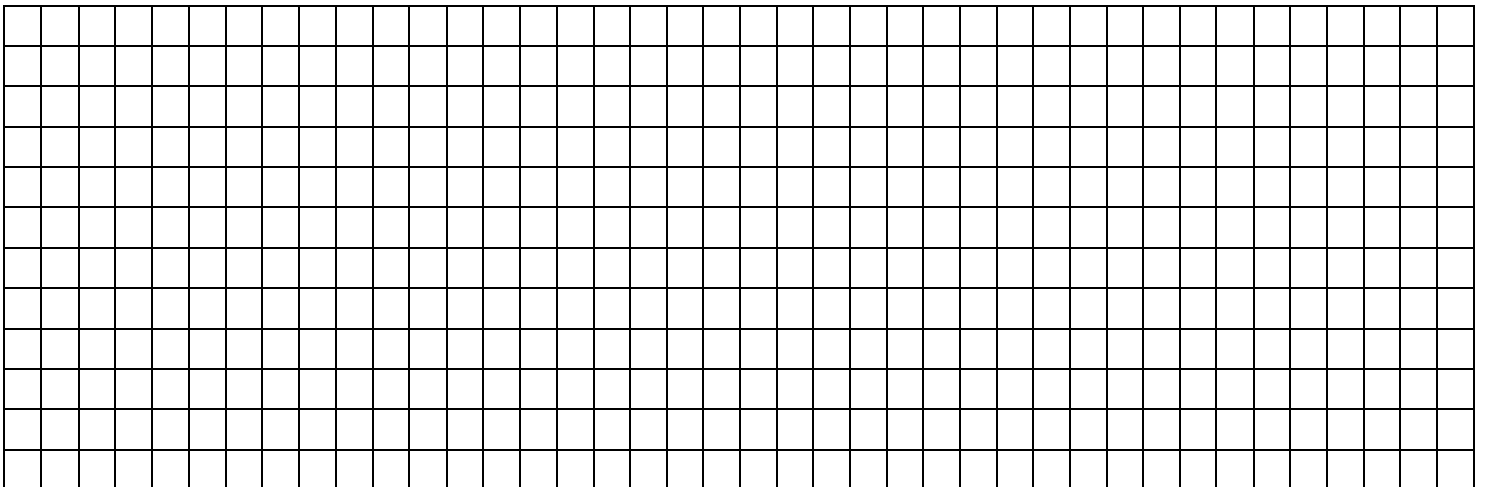
4b. Explain how you know your answer is correct.

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**WORK SPACE**



**WORK SPACE**

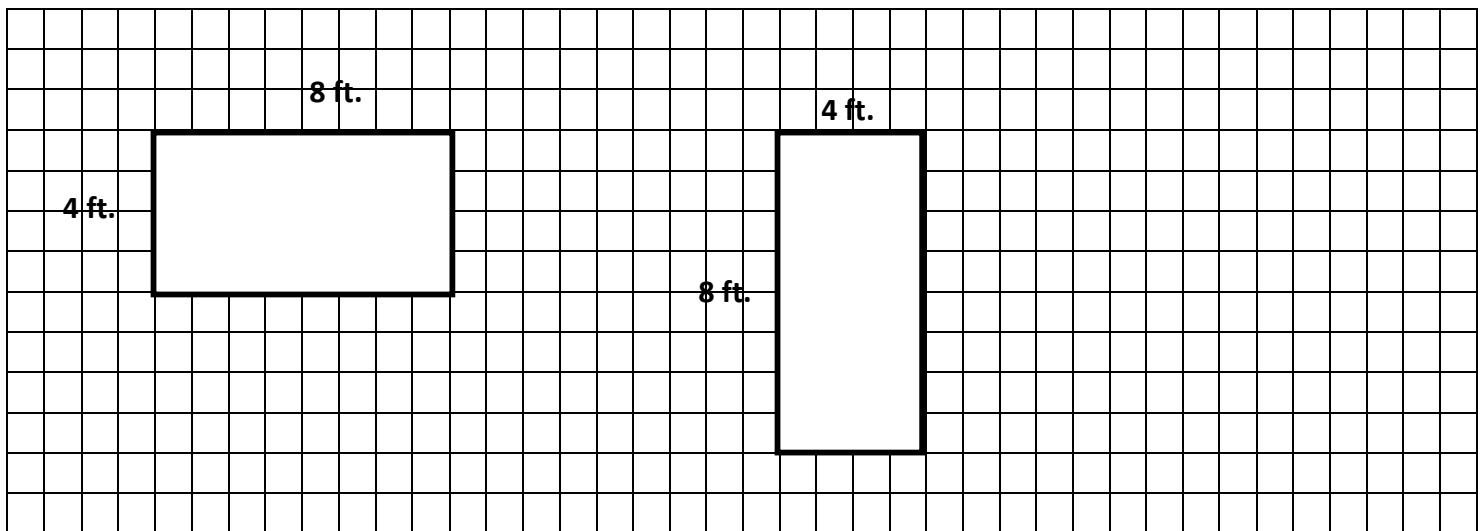
Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Formative Task: Mr. Buckle's Bulletin Board



Mr. Buckle has a bulletin board with a length of 8 feet and a width of 4 feet.

1. Draw and label Mr. Buckle's bulletin board.



2. Mr. Buckle wants to put border around the outside of his bulletin board. How many feet of border will he need? **Solve** and **write** an equation that shows how many feet of border Mr. Buckle will need.

**Show your work using numbers, drawings, or words in the work space on the next page.**

**Equation:  $8 + 8 + 4 + 4 = 24$  ft. or  $2(8) + 2(4) = 24$  ft. Answer: 24 feet**

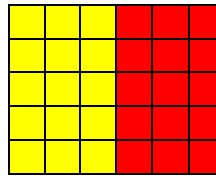
2. How many square feet of paper will Mr. Buckle need to cover the area of the entire board?

**Area of Mr. Buckle's Bulletin Board:  $8 \times 4 = 32$  sq. ft. *or***

**$8 + 8 + 8 + 8 = 32$  sq. ft. *or*  $4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 = 32$  sq. ft.**

4a. Mr. Buckle has sheets of bulletin board paper that **each** has an area of 18 square feet. How many sheets of paper will he need to cover another bulletin board with an area of 36 square feet?

**$36/18 = 2$  sheets of paper      or       $18 + 18 = 36$**



4b. Explain how you know your answer is correct.

**Possible explanation or any viable argument to justify solution:**

I knew that the area of the entire bulletin board was 36 square feet, so I divided it by 18, which is the area of the bulletin board paper. My answer is that Mr. Buckles will need 2 sheets of paper to cover his entire bulletin board.

## WORK SPACE



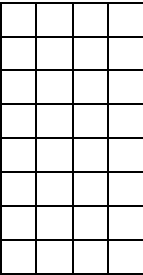
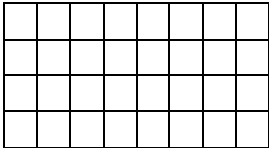
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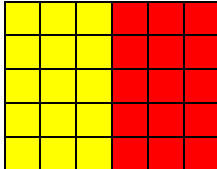
44



- Work with area and perimeter in a real world context
- Use tiling or multiplication strategies to find the area of rectangles
- Use addition or multiplication strategies to calculate the perimeter of rectangles
- Use division strategies to calculate the number of rectangular objects are needs to cover a fixed amount of area.

<b>Common Core Standards</b>	
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Strategies and Solutions	Points	Points
<p>1. Draws the bulletin board</p> <p><b>Possible solutions: 8 x 4, 4 x 8</b></p> <p>Labels the yard with the correct length and width</p> <p><b>Possible solutions:</b></p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>4 ft.</p>  <p>8 ft.</p> </div> <div style="text-align: center;"> <p>8ft.</p>  <p>4 ft.</p> </div> </div>	<p>1</p> <p>1</p>	<p>2</p>
<p>2. Shows equation for perimeter, such as repeated addition or <math>2(L) + 2(W)</math>.</p> <p><b>Possible solutions:</b></p> <p><math>8 + 8 + 4 + 4 = 24 \text{ ft.}</math></p> <p><math>2(8) + 2(4) = 24 \text{ ft.}</math></p> <p>Gives correct answer based on the strategy used with the correct measurements.</p>	<p>1</p> <p>1</p>	<p>2</p>
<p>3. Shows equation for area, <math>l \times w</math>, or draws the correct number of square units and adds them together accurately.</p> <p><b>Possible solution: <math>8 \times 4 = 32 \text{ sq. ft.}</math></b></p> <p><b><math>8 + 8 + 8 + 8 = 32 \text{ sq. ft.}</math></b></p> <p><b><math>4+4+4+4+4+4+4+4 = 32 \text{ sq. ft.}</math></b></p> <p style="text-align: center;"><i>or</i></p> <p><b>Correctly draws area models shown below:</b></p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p>Labels the area of the bulletin with the correct unit of measure.</p>	<p>1</p> <p>1</p>	<p>2</p>

<p><b>3.MD.8:</b> Solve real-world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.<b>3.MD.7b:</b> Relate area to the operations of multiplication and addition:</p> <p>b. Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real-world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning.</p>	<p>4a. Shows the correct amount of paper that is needed to cover the bulletin board, by either dividing the area of the bulletin board by the area of a sheet of paper or drawing the correct of paper and adding them. Gives the correct answer with appropriate square units.</p> <p><b>Possible solutions: <math>36 \div 18 = 2</math> sheets of paper</b>  <b>or</b>  <b><math>18 + 18 = 36</math></b></p>  <p>4b. Gives a correct explanation and shows sufficient reasoning such as:</p> <p><b>I knew that the area of the entire bulletin board was 36 square feet, so I divided it by 18, which is the area of the bulletin board paper. My answer is that Mr. Buckles will need 2 sheets of paper to cover his entire bulletin board.</b></p> <p><b>or</b></p> <p><b>Any other logical explanation justifying a correct strategy and solution.</b></p>	1	
		1	2
Total Points		8	

# FORMATIVE TASK: MR. BUCKLE’S BULLETIN BOARD

## TEACHER NOTES

### Introduction

This assessment is designed to assess students’ understanding of the relationship between area and perimeter to solve real-world problems. In addition, this task assesses students’ ability to use addition and multiplication operations to calculate the area and perimeter of a shape. Students use multiple representations such as equations, area models, tiling, and written expression to demonstrate understanding of the key concepts embedded in measurement of the area and perimeter of polygons. Below is a table of suggestions and feedback to address possible misconceptions students may still have after administering this formative assessment. Please reference the “Learning Plan Activities” section to give further support in addressing some of the misconceptions outlined below.

### Purposeful Questioning and Feedback to Address Misconceptions

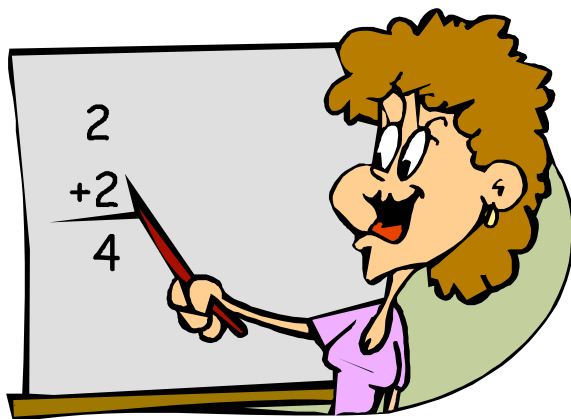
Misunderstandings	Suggested Prompts or Questions
<p>Students had difficulty using the correct amount of squares in order to show an accurate measurement of each side.</p> <p>Students could not generate a rectangle from the given dimensions.</p> <p>Students either did not label the sides properly or did not label the sides at all.</p>	<ul style="list-style-type: none"> <li>• How many boxes do you need to count to represent 12 feet by 6 feet?</li> <li>• What does length and width mean?</li> <li>• What are the attributes of a rectangle?</li> <li>• What is the question asking you to do?</li> <li>• When using measurements, what does it mean to label?</li> </ul>
<p>Students had difficulty understanding the meaning of <i>equation</i>.</p> <p>Students incorrectly used the equation <i>length x width</i> to calculate the perimeter.</p> <p>Students confused the formula for perimeter with the formula for area.</p>	<ul style="list-style-type: none"> <li>• Another word for <i>equation</i> is <i>number model</i> or <i>number sentence</i>.</li> <li>• How many sides do you need to add in order to find the perimeter of a rectangle?</li> <li>• What is another word for the distance around a shape?</li> </ul>
<p>Students did not recognize that the perimeter is a linear measurement, and did not include the outer squares in their calculations of area.</p>	<ul style="list-style-type: none"> <li>• What does the area measure?</li> <li>• How can we measure the area of a rectangle?</li> <li>• How can we measure the area of a rectangle using square units?</li> </ul>
<p>Students were unable to apply the information in the question (1 sheet of paper = 36 square feet) when finding the numbers of sheets needed.</p>	<ul style="list-style-type: none"> <li>• How many square feet was each piece of paper?</li> <li>• Have students re-read the question.</li> <li>• What do you think the question is asking you to do?</li> <li>• Can you show me a model of the bulletin board using information from the task?</li> </ul>

# Mathematics



## GRADE 3 MATH: CHRIS' GARDEN DILEMMA

### LEARNING PLAN ACTIVITIES





# Rulers Rule!!

**Topic:** Measurement

**Duration:** 90-Minute Math Block

**Materials/Instructional Resources:**

Differentiated worksheets (Use Page A for Advanced Group; use Page B for Beginner/Intermediate Group)

Dry eraser markers

SMART board, chart paper, or blackboard

Rulers

Exit Slips

## OBJECTIVE(S)

- Students will accurately utilize rulers to draw the correct measurements of a polygon to calculate the perimeter in whole inches and/or centimeters.
- Students will use a key and scale to represent perimeter.

## ESSENTIAL QUESTIONS

- How can using a ruler to draw the measurements of a polygon help to determine the perimeter?
- How can we use a scale to show the perimeter of large polygons?

## COMMON CORE STANDARDS

- **3.MD.8:** Solve real-world problems involving perimeter of polygons, including finding the perimeter given the side lengths.

## MATHEMATICAL PRACTICES

- MP.1** Make sense of problems and persevere in solving them.
- MP.2** Construct viable arguments and critique the reasoning of others.
- MP.3** Model with mathematics.
- MP.5** Use appropriate tools strategically.
- MP.6** Attend to precision.

## KEY TERMS AND VOCABULARY

Unit of measure, inches, border, centimeters, scale, key, feet, edging

## LEARNING PLAN

**Procedure:**

**Whole Group:**

- \* First, the teacher will give students their own rulers and inform them that their task is to identify the features of the ruler. Students should identify the units of measurement.
- \* The teacher will then begin to show students how to draw an object with the correct measurements, using a ruler.

- \* First, the teacher will use a ruler, beginning at the 0 mark, and draw a line that is 6 inches long on the blackboard, chart paper, or SMART board.
- \* Then, starting at the 0 mark again, the teacher will draw another line that is 3 inches long.
- \* The teacher will then ask, "If I want to draw a rectangle, how long do the other sides have to be?"
- \* Using the students' answers, the teacher will draw the remaining sides of the rectangle.
- \* Next, the teacher will explain that he/she wants to find the perimeter of this rectangle.
- \* The teacher will then ask, "Who can explain what perimeter is?" and, "If I wanted to find the perimeter of this rectangle, how can I?"
- \* After listening to the students' answers, the teacher will then model how to find the perimeter by taking the measurements of all 4 sides and adding them together. ( $6 + 6 + 3 + 3 = 18$  inches)
- \* Next, the teacher will draw two sides of a new rectangle.
- \* Students will name the lengths of these two sides and give the lengths of the remaining sides.
- \* The teacher will ask the students to find the perimeter of this polygon and review the students' findings.
- \* The teacher will ask, "Suppose we wanted to represent the perimeter of a large space, such as this room, on the paper that we have?" The teacher will introduce the idea of a scale in which one inch/centimeter equals one foot/yard/meter, and show how to indicate that in a key.
- \* When finished, the students will break into small groups.

#### **Small Group:**

- \* The teacher will group the students homogenously.
- \* The students will work in pairs on differentiated tasks (see attached sheets).
- \* The students will draw a polygon and find the perimeter with sides measured to the inch or centimeter.
- \* The teacher should act as a facilitator, allowing the students to explore and use their own skills.
- \* The teacher will work one-to-one with those students who are having the most difficulty.
- \* Finally, while the students are working, the teacher will assess their understanding by observing their work.

#### **Whole Group:**

- \* Once the students are finished with their tasks, the teacher will then ask, "In what units can a figure be measured and represented? What are we measuring when we measure the distance around a figure? How can you use partial measurements of a figure to find the perimeter?"
- \* **Number Talk:** The students will share and express their opinions about today's lesson and tasks. The students will be encouraged to participate respectfully.
- \* **Exit Slips:** The students will complete an Exit Slip reflecting on the day's lesson. They will explain what they learned about scale and solving perimeter problems.

#### **Extension:**

- \* After this lesson is completed, the next step should be to teach a lesson having students use a ruler to measure the sides of an object and to use the measurements to find perimeter and area.

#### **DEPTH OF KNOWLEDGE (DOK) LEVELS**

**DOK Level 1:** Students will use a ruler correctly to draw rectangles of given dimensions.

**DOK Level 2:** Students will use two given sides and a ruler to draw a rectangle accurately and find its perimeter.

**DOK Level 3:** Students will use a scale and key to represent a large rectangle and find its perimeter, given two sides.

#### **UDL SUPPORT STRATEGIES**

##### **Representation:**

- ✓ Display picture of a mirror highlighting what is the border.
- ✓ Bullet in the math task activity sheets the important sentences for the dimensions of the mirror.

##### **Action and Expression:**

- ✓ Foster collaboration and communication through partner activities to discuss and share solutions.
- ✓ Allow some students to verbally explain their answers.

##### **Engagement:**

- ✓ Allow 5 minutes for students to break when necessary.
- ✓ Exit Slips will allow the students to reflect on their learning and reinforce their understanding of the lesson.
- ✓ Small group work where students can receive math help from a peer they are comfortable with.
- ✓ Small group work to minimize distractions.
- ✓ Allow students to work outside the classroom in a quieter environment.

Name: \_\_\_\_\_

Date: \_\_\_\_\_

### Mary's Marvelous Mirror



Mary has a marvelous mirror in her room that she uses every day. The mirror had a border that went around the edging of the mirror, but it broke. Mary wants to replace the border, but does not know how many feet she will need. The mirror is 9 inches long and 5 inches wide. Please help Mary **draw** the mirror and **find** the correct amount of border she will need.

- **Complete the work in the space below**
- **Write a sentence telling Mary how much border she needs**

Name: \_\_\_\_\_

Date: \_\_\_\_\_

### Mary's Marvelous Mirror



Mary has a marvelous mirror in her room that she uses every day. The mirror had a border that went around the edging of the mirror, but it broke. Mary wants to replace the border, but does not know how many feet she will need. The mirror is 5 inches long and 2 inches wide. Please help Mary **draw** the mirror and **find** the correct amount of border she will need.

- **Complete the work in the space below**
- **Write a sentence telling Mary how much border she needs**

Name: \_\_\_\_\_

Date: \_\_\_\_\_

### A Home for Scruffy



Scruffy is a local puppy that wanders around the neighborhood. Everyone feels bad because he doesn't have a safe place to play. All of the neighbors decided to make a safe place for Scruffy where he can play. They want Scruffy's play area to be 9 feet long and 3 feet wide. They want to add fencing around the space, but they don't know how much they need. Please help Scruffy's neighbor draw a model of the play area and find the amount of fencing that is needed.

Make a model where 1 inch is equal to 1 foot.

**Complete the work in the space below. Be sure to label your length and width.**

Total amount of fencing: \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

### A Home for Scruffy



Scruffy is a local puppy that wanders around the neighborhood. Everyone feels bad because he doesn't have a safe place to play. All of the neighbors decided to make a safe place for Scruffy where he can play. They want Scruffy's play area to be 6 feet long and 2 feet wide. They want to add fencing around the space, but they don't know how much they need. Please help Scruffy's neighbor draw a model of the play area and find the amount of fencing that is needed.

Make a model where 1 inch is equal to 1 foot.

**Complete the work in the space below. Be sure to label your length and width.**

Total amount of fencing: \_\_\_\_\_

# Using Measurement Tools Strategically

**Topic:** Perimeter

**Duration:** 90-Minute Math Block

**Materials/Instructional Resources:**

Differentiated worksheets

Exit Slips

Sticky notes

Straightedge

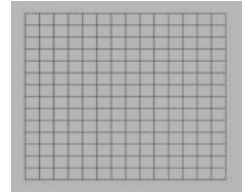
Highlighters

SMART board, chart paper, blackboard

Centimeter graph paper

Math journal

Wiki sticks



## OBJECTIVE(S)

- Students will use graph paper to draw a figure accurately.
- Students will use graph paper to find the perimeter of a figure.

## ESSENTIAL QUESTIONS

- How can graph paper help you to draw a figure with the correct measurements?
- How can graph paper help you to accurately calculate the perimeter of a figure?

## COMMON CORE STANDARDS

- **3.MD.8:** Solve real-world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different area and different perimeters.

## MATHEMATICAL PRACTICES

- MP.1** Make sense of problems and persevere in solving them.
- MP.3** Construct viable arguments and critique the reasoning of others.
- MP.4** Model with mathematics.
- MP.5** Use appropriate tools strategically.
- MP.6** Attend to precision.

## KEY TERMS AND VOCABULARY

Unit of measure  
Graph paper

Inches  
Unit square

Centimeters  
Perimeter

Feet  
Dimensions

## LEARNING PLAN



## **Procedure:**

### **Whole Group:**

- \* The lesson will begin with an assessment of the students' knowledge of graph paper.
- \* Each student will be given a sticky note, and they will be told to "Stop and Jot" on the sticky notes.
- \* They will write down as many features of graph paper as they see (squares, lines, rows, columns, etc.).
- \* The teacher will ask questions such as "What is this called?" and "What can it be used for?"
- \* The teacher will then quickly review the properties of the graph paper, stating, "The graph paper you see in front of you is centimeter graph paper. Therefore, what are the dimensions of each square?"
- \* The teacher will explain that the squares on graph paper may be various units such as centimeters, inches, half-inches, two centimeters, and can be referred to as "square units".
- \* Next, the teacher will say, "Today, we are going to learn how to use graph paper to find the perimeters of figures", and ask, "Who can define perimeter?"
- \* On the SMART board, chart paper, or blackboard the teacher will present graph paper.
- \* The teacher will explain that he/she wants to draw a rectangle that is 7 centimeters long and 15 centimeters wide.
- \* After giving these measurements, the teacher will then model how to draw the rectangle with the correct measurements.
- \* The teacher will begin to count 7 units for the length, and mark every unit that is counted.
- \* The teacher will do the same thing for the width, which is 15 units.
- \* The teacher may ask questions such as, "If the shape is a rectangle, what are the measurements of the opposite sides?" and, "Explain how you came up with this answer."
- \* The teacher will complete the drawing of the rectangle by drawing all of the sides and counting the units to model how to check that the work is done correctly.
- \* Then the teacher will demonstrate how to count all of the sides around the "rim" of the rectangle. Students will find the perimeter of 44 centimeters.
- \* The teacher will review the steps taken as reinforcement before the students are given small group work.

### **Small Group:**

- \* The students will be given tasks to complete in pairs (see attached sheets).
- \* The teacher will facilitate the groups as necessary.
- \* While the students are working, the teacher will informally ask them questions to assess their understanding and reasoning such as, "When drawing a rectangle on graph paper, do we need to know the measurements of all sides? Why or why not?"

### **Whole Group:**

- \* Once the students are finished they will regroup.
- \* Next, the teacher will ask for volunteers to share their answers and the strategies they utilized.
- \* While the students are sharing, the other students will be asked to participate by critiquing the reasoning of their classmates' answers.
- \* Finally, the students will reflect on today's lesson in their math journals. They will state what they have learned and how they can apply what they learned to a real-life situation.
- \* The teacher may ask some students to share their reflections.

## DEPTH OF KNOWLEDGE (DOK) LEVELS

**DOK Level 1:** Students will reiterate the meaning of perimeter and use graph paper to draw a figure of given dimensions.

**DOK Level 2:** Students will use their knowledge of the characteristics of a rectangle in order to find the missing sides.

**DOK Level 3:** Students will explain the steps they took in order to complete the task, give an explanation of the reasoning they used, and reflect on their learning.

## UDL SUPPORT STRATEGIES

### **Representation:**

- ✓ Use of highlighters on graph paper so students can better visualize what perimeter is.
- ✓ Wiki sticks for students to line up along the perimeter to visually use as a barrier.
- ✓ Use of a ruler as a straightedge to help students draw straight lines.

### **Action and Expression:**

- ✓ Give students a checklist to use when solving the task.
- ✓ Allow some students to list the steps they took, rather than reflecting on their learning as a journal entry.
- ✓ Foster collaboration and communication through partner activities to discuss and share solutions.
- ✓ Use of Exit Slips to allow students to describe and express their thoughts about the lesson.

### **Engagement:**

- ✓ Allow a 5-minute break for students if necessary.
- ✓ Exit Slips will allow the students to reflect on their learning.
- ✓ Small group work to minimize distractions.
- ✓ Allow students to work outside the classroom in a quieter environment.
- ✓ Math help from a peer they are comfortable with.

Name: \_\_\_\_\_

Date: \_\_\_\_\_

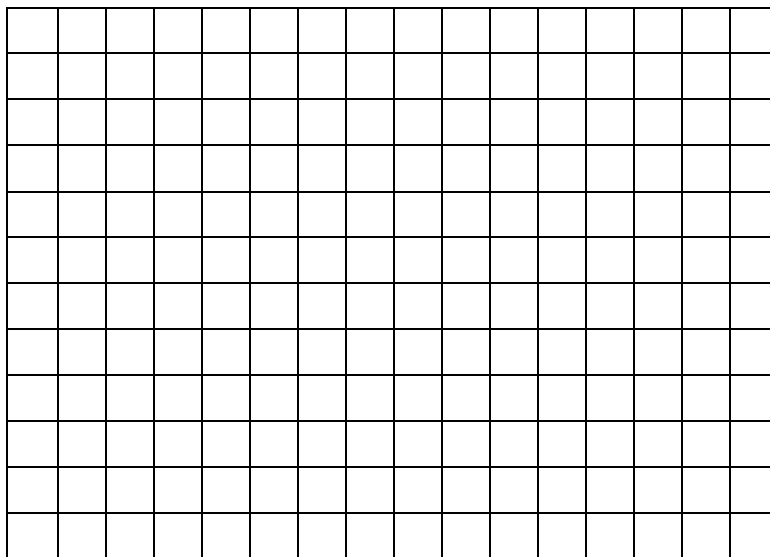
### Joe's Joyful Picture



Read and solve the problems below:

Joe painted a beautiful picture with flowers. He wants to put a frame around the outside. The frame is 7 feet long and 4 feet wide. How many feet of framing does he need to go around the frame?

Show your work using the graph paper below.  
**Each square represents 1 square foot.**



Answer: \_\_\_\_\_ feet of border

Name: \_\_\_\_\_

Date: \_\_\_\_\_

## Blossoming Border

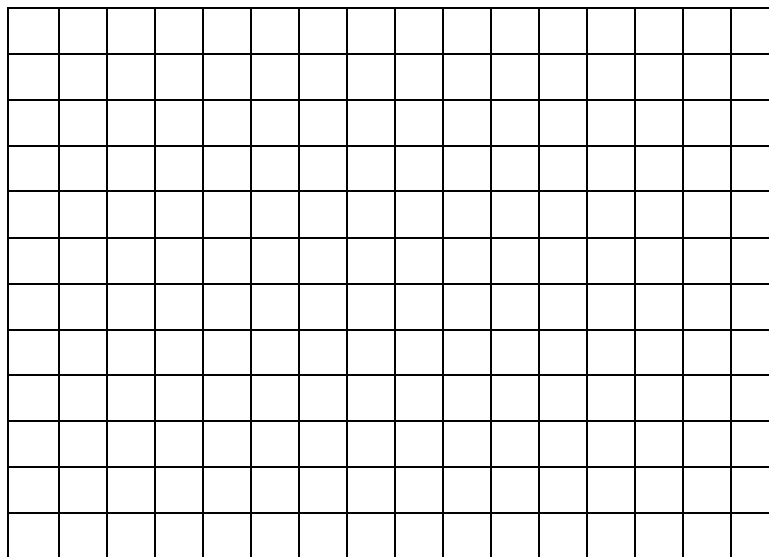


Read and solve the word problem below:

Christina is putting border around her bulletin board outside her classroom. She wants to put a flowered border **around** the bulletin board. The bulletin board is 8 feet long and 3 feet wide. Christina is not sure how much border she will need. Please help Christina figure out how much border she needs.

**Each square represents 1 square foot.**

**Use the graph paper below to help you solve the problem.**



Answer: \_\_\_\_\_ feet of border



## Cheez-It Up!



**Topic:** Perimeter

**Duration:** 45 to 50 minutes

**Materials/Instructional Resources:**

- Graph paper (1 inch square)
- Ziplock bags
- Math journal
- Pencil
- Cheese crackers (if you do not want to use food, you may use colored 1" x 1" tiles)

### OBJECTIVE(S)

- Students will learn that *perimeter* is the distance around a figure or area.
- Students will learn how to find a perimeter by adding or counting the unit squares around a polygon.

### ESSENTIAL QUESTIONS

- Why is knowing how to calculate perimeter important?
- What are some situations outside the classroom in which we might need to know how to find perimeter?

### COMMON CORE STANDARDS

- **3.MD.8:** Solve real-world and mathematical problems involving perimeters of polygons, including finding the perimeter given side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same areas and different perimeters.

### MATHEMATICAL PRACTICES

- **MP.1** Make sense of problems and persevere in solving them.
- **MP.2** Reason abstractly and quantitatively.
- **MP.3** Construct viable arguments and critique the reasoning of others.
- **MP.4** Model with mathematics.
- **MP.5** Use appropriate tools strategically.

### KEY TERMS AND VOCABULARY

Perimeter  
Distance

Graph Paper  
Polygon

Unit Square  
Length

Width

## LEARNING PLAN

### Procedure:

#### Whole Group Instruction:

- \* Teacher will start lesson by telling students they will learn how to find the perimeter of a rectangle. Make sure the class is aware that squares are rectangles, and so students will be working with squares in these activities.
- \* Teacher will ask students to turn and talk to a partner and discuss what they already know about perimeter (2 minutes). Students will then share what they discussed.
- \* Teacher will explain that in today's lesson, students will use graph paper and cheese crackers to help them understand how to find the perimeter of a polygon/shape. (If you are not comfortable using food, you can use 1-inch colored tiles.)
- \* Teacher will display 1-inch graph paper on overhead or Elmo.
- \* Teacher will then show students a cheese cracker.  
Ask: How many cheese crackers do I have? (1)  
How many sides does it have? (4)
- \* Teacher will then place cheese cracker on one square unit on graph paper. (This is so students can see that the sides of one cheese cracker correspond to the perimeter of one square unit on the graph paper.)
- \* Teacher will then tell students that the perimeter of the cheese cracker or the perimeter of one square unit is 4. Students are counting or adding how many sides are around the figure. (This is the time teacher should reinforce the meaning of perimeter. *Perimeter* is the distance around a polygon/area.)
- \* Teacher will repeat above activity with two, then three, cheese crackers so students have a good understanding of how to find perimeter using cheese crackers and unit squares on graph paper. (Some students may count touching sides of the cracker when crackers are put together; the teacher should be aware of this misunderstanding.)



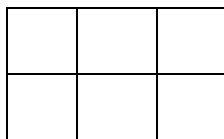
1 x 2

Perimeter = 6



2 x 1

Perimeter = 6



2 x 3

Perimeter = 10



3 x 1

Perimeter = 8

#### Independent Work:

- Teacher will give each student a ziplock bag with some cheese crackers. (Note: Packaging should be done prior to lesson. When packaging, teacher should put different quantities of cheese crackers in bags so not every student gets the same perimeter. Teacher should also consider the number of crackers that students can handle. Students who need extra support should probably get no more than four or five).
- Students will be instructed to find the perimeter of their cheese crackers when put together. Students will need to place cheese crackers on graph paper. This will help students make the connection that one cheese cracker equals one unit square (5 minutes).
- Teacher will then have students share the perimeter of their cheese crackers. During this time, ask the following:

- How many cheese crackers did you use?
- What shapes did you make?
- How many cheese crackers did you use for the length? Width?
- How did you find the perimeter?
- What was your perimeter?
- Did you try putting your cheese crackers in a different arrangement? If so, did the perimeter change? Explain why or why not.
- Once students have shared, ask students to carefully place cheese crackers in bag. They will need to use them for the next activity.

#### **Small Group Partner Work (5 to 10 minutes):**

- Teacher will assign students to a partner.
- Students will be instructed to work with their partners and combine or put together their cheese crackers. They are to place crackers on a shared piece of graph paper. Students are then asked to find the perimeter. Students will be encouraged to arrange their crackers vertically and horizontally. During this time, students will turn and talk about their findings. They will then be instructed to take out their journals to write and explain what they did with the cheese crackers in order to find the perimeter.
- Teacher will ask students to share their observations on working with different quantities of cheese crackers. Questions that were asked after independent activity should also be asked here:
  - How many cheese crackers did you use?
  - How did you arrange them?
  - How many cheese crackers did you use for the length? Width?
  - How did you find the perimeter?
  - What was your perimeter?
  - Did you try putting your cheese crackers in a different arrangement? If so, did the perimeter change? Explain why or why not

#### **Whole Group Share (5 minutes):**

- Teacher will ask students what they learned from today's lesson.
- Essential Understanding: The distance around a figure is its perimeter. To find the perimeter of a polygon, add the lengths of the sides.
- Teacher will ask and have students discuss essential questions: Why is knowing how to calculate perimeter important? What are some situations outside the classroom in which we might need to know how to find perimeter?

#### **Follow Up:**

See attached activity sheets.

### **UDL SUPPORT STRATEGIES**

#### **Representation:**

- ✓ Enlarge grid paper.
- ✓ If students are having a difficult time counting the outside of the cheese crackers, provide students with a variety of colored tiles. When tiles are side by side, students will be able to identify each side because the colors will be different.
- ✓ Teacher should consider the number of crackers that students can handle. Students who need extra support should probably get no more than four or five.
- ✓ A chart or index card can be placed on wall or desk with new vocabulary words for this lesson.
- ✓ The word **PERIMETER** has the word **rim**; **rim** means “around”.
- ✓ Teacher can provide students with a highlighter or wiki stick to outline the outside of their shapes.
- ✓ Teacher can post step-by-step directions of activities on SMART board or white board.
- ✓ Teacher will give verbal directions.

**Action and Expression:**

- ✓ Foster collaboration through partner activities and shared solutions.

**Engagement:**

- ✓ Hands-on-activities with cheese crackers and grid paper.
- ✓ Partner work activity.

**DEPTH OF KNOWLEDGE LEVELS (DOK)**

**DOK Level 1:** Students have to calculate perimeter based on arrangements made with cheese crackers.

**DOK Level 2:** Given a certain number of cheese crackers, students have to organize them in different ways to see if perimeter changes.

**DOK Level 3:** Students have to extend their understanding of perimeter and explain how they can use their knowledge of perimeter outside the classroom.

*Lesson adapted from Sonja McGinnis, ©2012*





## FINDING PERIMETER WITH CHEEZ-ITS

Each student/pair needs at least 16 crackers or colored tiles.

**Draw It** (Note: You do not have enough room to draw the models full-size.)

Form your Cheez-Its into a length of 4 and width of 4:

What is the perimeter? \_\_\_\_\_

---

Form your Cheez-Its into a length of 3 and width of 4:

What is the perimeter? \_\_\_\_\_

---

Form your Cheez-Its into a length of 2 and width of 4:

What is the perimeter? \_\_\_\_\_

---

Form your Cheez-Its into a length of 1 and width of 4:

What is the perimeter? \_\_\_\_\_

---

Form your Cheez-Its into a length of 2 and width of 3:

What is the perimeter? \_\_\_\_\_

Adapted from Sonja McGinnis, ©2012

Form your Cheez-Its into a length of 3 and width of 3:

What is the perimeter? \_\_\_\_\_

---

Form your Cheez-Its into a length of 1 and width of 3:

What is the perimeter? \_\_\_\_\_

---

Form your Cheez-Its into a length of 1 and width of 2:

What is the perimeter? \_\_\_\_\_

---

Use 1 Cheez-It to form a length of 1 and width of 1.

What is the perimeter? \_\_\_\_\_

---

Make a new arrangement of Cheez-Its:

What is the perimeter? \_\_\_\_\_

---

Short Answer: Describe how you arranged your Cheez-Its and explain how you derived the perimeter.

Adapted from Sonja McGinnis, ©2012



## Cheez - It Up!



**Topic:** Area

**Duration:** 45 to 50 minutes

**Materials/Instructional Resources:**

Graph paper (1 inch square)

Cheese crackers (if you do not want to use food, you may use colored 1" x 1" tiles)

Ziplock bags

Math journal

Pencil

### OBJECTIVE(S)

- Students will learn that *area* is the number of square units needed to cover a region.
- Students will learn that they can count square units to find the area when putting together a given number of unit squares (cheese crackers, tiles).
- Students will learn how to find the area of a region by adding or counting squares units in it.

### ESSENTIAL QUESTIONS

- When might you need to find the number of square units needed to cover a region?
- How can you apply what you learned about square units to solve an area problem?

### COMMON CORE STANDARDS

- **3.MD.5:** Recognize area as an attribute of plane figures and understand concepts of area measurement.
  - A square with side length of one unit, called a "unit square," is said to have "one square unit" of area, and can be used to measure area.
  - A plane figure which can be covered without gaps or overlaps by  $n$  unit squares is said to have an area of  $n$  square units.
- **3.MD.6:** Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).

### MATHEMATICAL PRACTICES

- **MP.1** Make sense of problems and persevere in solving them.
- **MP.2** Reason abstractly and quantitatively.
- **MP.3** Construct viable arguments and critique the reasoning of others.
- **MP.4** Model with mathematics.
- **MP.5** Use appropriate tools strategically.

## KEY TERMS AND VOCABULARY

Area  
Space/Region

Graph Paper  
Polygon

Unit Square  
Length

Square Unit  
Width

## LEARNING PLAN

### Procedure:

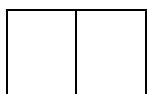
### Whole Group:

- \* Teacher will start lesson by telling students they will learn how to find the area of a polygon.
- \* Teacher will ask students to turn and talk to a partner and discuss what they already know about area (2 minutes). Students will then share what they discussed.
- \* Teacher will explain that in today's lesson, they will use graph paper and cheese crackers to learn how to find the area of a polygon. (If you are not comfortable using food, you can use 1-inch colored tiles.)
- \* On overhead or Elmo, teacher will display 1-inch graph paper.
- \* Teacher will then show students a cheese cracker.

Ask: How many cheese crackers do I have? (1)

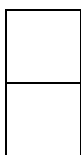
Say: One cheese cracker represents 1 square unit. Therefore the *area* of this cheese cracker is 1 square unit.

- \* Teacher will then place cheese cracker on one square unit on graph paper so students see that one cheese cracker covers or takes the space of one square unit on the graph paper.
- \* Teacher will then tell students that the area of one cheese cracker is 1 square unit. Teacher should review the meaning of area. *Area* is the amount of space in region. Teacher will repeat above activity with 2, 3, and 6 cheese crackers so students have a good understanding of how to find area using cheese crackers and square units on graph paper. (Teacher should reinforce that when placing cheese crackers on graph paper, crackers cannot overlap and there cannot be any gaps.)



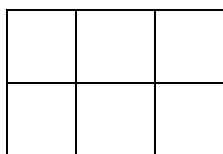
1 x 2

Area = 2 square units



2 x 1

Area = 2 square units



2 x 3

Area = 6 square units



3 x 1

Area = 3 square units

### Independent Work:

- \* Teacher will give each student a ziplock bag with some cheese crackers (Note: Packaging should be done prior to lesson. When packaging, teacher should put different quantities of cheese crackers in bags so not every student gets the same number. Teacher should also consider the number of crackers that students can handle. Students who need extra support should probably get no more than four or five.)
- \* Students will be instructed to find the area covered by their cheese crackers. Remind students that when placing cheese crackers on graph paper, crackers cannot overlap and there cannot be any gaps. Allowing students to place cheese crackers on graph papers will help students make the connection that one cheese cracker equals one square unit (5 minutes).
- \* Teacher will then have students share the area of their cheese crackers when they are placed with at

least one full side of each cracker touching at least one full side of another. Be aware the some students may form arrangements that are not rectangular. During this time, ask the following:

- \*How many cheese crackers did you use?
- \*What shapes did you make?
- \*How many cheese crackers did you use for the length? Width?
- \*How did you find the area?
- \*What was your area?
- \*Did you try putting your cheese crackers in a different arrangement? If so, did the area change? Explain why or why not.

- \* Once students have shared, ask them to carefully place cheese crackers in bag. They will need them for the next activity.

### **Small Group Partner Work (5 to 10 minutes):**

Teacher will assign students to a partner.

- \* Students will be instructed to work with their partners and combine or put together their cheese crackers. They are to place crackers on a shared piece of graph paper. Students are then asked to find the area. Students will be encouraged to arrange their crackers vertically or horizontally in  $4 \times 5$  or  $3 \times 2$ , depending on the number of cheese crackers they have. During this time, students will turn and talk about their findings. They will then be instructed to take out their journals to write and explain what they did.
- \* Teacher will ask students to share their observations. (Questions that were asked after independent activity should also be asked here.)
  - \*How many cheese crackers did you use?
  - \*What shapes did you make?
  - \*How many cheese crackers did you use for the length? Width?
  - \*How did you find the area?
  - \*What was your area?
  - \*Did you try putting your cheese crackers in a different arrangement? If so, did the area change? Explain why or why not.

### **Whole Group Share (5 minutes):**

- \* Teacher will ask students: "What did you learn from today's lesson?"
- \* Essential Understanding: The amount of space inside a region is its *area*. One way to find area is counting the square units that cover the region.
- \* Teacher will ask and have students discuss essential questions.
  - \*When might you need to find the number of square units needed to cover an area?
  - \*How can you apply what you learned in today's lesson to solve an area problem?

### **Follow Up:**

See attached activity sheets.

## UDL SUPPORT STRATEGIES

### **Representation:**

- ✓ Enlarge grid paper.
- ✓ If students are having a difficult time counting cheese crackers because they are the same color, provide students with a variety of colored tiles. When tiles are side by side, students will be able to identify each side because the colors will be different.
- ✓ Teacher should consider the number of crackers that students can handle. Students who need extra support should probably get no more than four or five.
- ✓ Lines on graph paper can be darkened or highlighted.
- ✓ A chart or index card can be placed on wall or desk with new vocabulary words for this lesson.
- ✓ Students who have difficulty with manipulatives may color in the square units to find the area.
- ✓ Teacher will give verbal directions.

### **Action and Expression:**

- ✓ Teacher can post step-by-step directions on SMART board or white board.

### **Engagement:**

- ✓ Foster collaboration through partner activities and shared solutions.
- ✓ Create expectations for group work.
- ✓ Teachers give ongoing feedback on student progress.

## DEPTH OF KNOWLEDGE LEVELS (DOK)

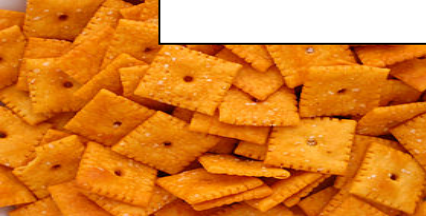
**DOK Level 1:** Students calculate area based on arrangements made with cheese crackers.

**DOK Level 2:** Given a certain number of cheese crackers, students have to organize cheese crackers in different ways to see if area changes.

**DOK Level 3:** Students have to extend their understanding of area and explain how they might have to use this knowledge in situations outside the classroom.

Lesson adapted from Sonja McGinnis, ©2012

## ***FINDING AREA WITH CHEEZ-ITS***



Each student/pair needs at least 16 crackers.

**Directions:** Form rectangles. Show your work; you do not have enough room to trace the crackers. Then calculate the area.

Form your Cheez-Its into a 4 x 4 rectangle. Draw and label.

What is the area? \_\_\_\_\_

---

Form your Cheez-Its into a 3 x 4 rectangle. Draw and label.

What is the area? \_\_\_\_\_

---

Form your Cheez-Its into a 2 x 4 rectangle. Draw and label.

What is the area? \_\_\_\_\_

---

Form your Cheez-Its into a 1 x 4 rectangle. Draw and label.

What is the area? \_\_\_\_\_

---

Form your Cheez-Its into a 2 x 3 rectangle. Draw and label.

What is the area? \_\_\_\_\_



Form your Cheez-Its into a 3 x 3 rectangle. Draw and label.

What is the area? \_\_\_\_\_

---

Form your Cheez-Its into a 1 x 3 rectangle. Draw and label.

What is the area? \_\_\_\_\_

---

Form your Cheez-Its into a 1 x 2 rectangle. Draw and label.

What is the area? \_\_\_\_\_

---

Use 1 Cheez-It. Draw and label.

What is the area? \_\_\_\_\_

---

Make a new arrangement of Cheez-Its. Draw and label.

What is the area? \_\_\_\_\_

---

**Written Response:**

Describe your arrangement and explain how you solved the area.

# The Area of It All

**Topic:** Area. This activity is intended for students who have learned that the area of a rectangle can be determined by multiplying length times width.

**Duration:** 90-Minute Math Block

**Materials/Instructional Resources:**

<i>How Big is a Foot</i> by Rolf Myller	Centimeter ruler
Tape measure	Worksheet
Pencil	Inch ruler
Yardstick	Meter stick

## OBJECTIVE(S)

- Students will be able to determine the area of a rectangle and express that measurement using appropriate unit labels.
- Students will determine area by using the formula *length x width*.
- Students will learn that area may be measured in the following units: square inches, square feet, square centimeters, square miles, or square meters.
- Students will understand that different units are appropriate for measuring regions of various sizes.

## ESSENTIAL QUESTION

- What units of measurement are appropriate for measuring area?

## COMMON CORE STANDARDS

- **3.MD.6:** Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).

## MATHEMATICAL PRACTICES

- MP.1** Make sense of problems and persevere in solving them.
- MP.2** Reason abstractly and quantitatively.
- MP.3** Construct viable arguments and critique the reasoning of others.
- MP.4** Model with mathematics.
- MP.5** Use appropriate tools strategically.
- MP.6** Attend to precision.

## KEY TERMS AND VOCABULARY

Perimeter  
Square (units)  
Area

Kilometers  
Metric  
Decimeters

Centimeters  
Inches  
Customary

Miles

**Procedure:****Whole Group (Read Aloud):**

- 1) Teacher will read aloud the story *How Big is a Foot?* by Rolf Myller. The story is about standard and non-standard measurement, the importance of measurement, and how it is used in situations outside the classroom. During the reading, the teacher pauses at intervals, so the children can turn and talk about the following:
  - a) What kinds of things are being measured?
  - b) Why do you think it is important to have standard units of measurement?
  - c) When might you have to measure outside of the classroom?

**Active Thinking Strategy:**

- 2) Display pictures of various rectangular areas: a television, a movie screen, a rug, a football field, a swimming pool, a tabletop, or a book, for example. Have students turn and talk about how the area of each might be measured. Why would we not use the same tools and units to measure each?

**Group Work:**

Students can work in groups of three or four.

- 3) Give students different measuring tools, such as a 12-inch ruler, 10-centimeter strip or centimeter ruler, measuring tape, yardstick, and meter stick.
- 4) Teacher will distribute a measurement recording worksheet and have students measure various rectangular objects around the classroom, such as a math textbook, an eraser, students' desktops, a light switch, the window in the door, the door, a floor tile, and the whiteboard. Students will select an appropriate unit of measurement for the length and width of each.
- 5) After about 10 minutes the teacher will discuss with the students which tools and units were best for measuring the different objects.
- 6) The teacher will remind the students of the following:

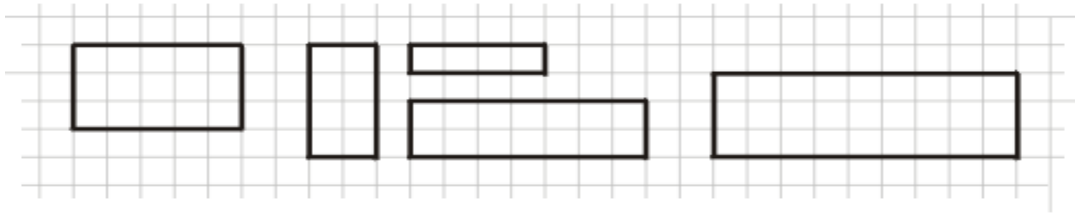
When we think of the *area* of something, we think how much surface it is covering (or would cover). For example, the football field covers a certain amount of ground. The stamp covers a tiny amount of surface. A sheet of paper covers more than a stamp but less than a football field.

*and*

Area is always measured in *square units*. People often use square inches, square feet, square miles, square centimeters, and square meters for measuring area. We can find the area of a rectangle by multiplying the length times the width.

## 7) Guided Practice:

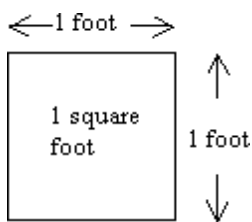
a. Find the areas of these rectangles. No particular unit is given, so we use “square units”.



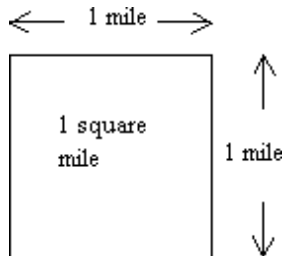
a. \_\_\_\_\_ square units    b. \_\_\_\_\_ square units    c. \_\_\_\_\_ square units

d. \_\_\_\_\_ square units    e. \_\_\_\_\_ square units

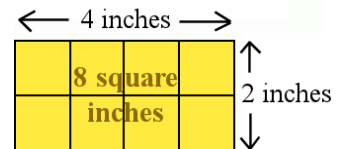
The following pictures are *not* to scale. They illustrate some other units of area.



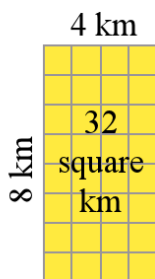
The area of this square is 1 square foot or  $1 \text{ ft}^2$ .



The area of this square is 1 square mile, or  $1 \text{ mi}^2$

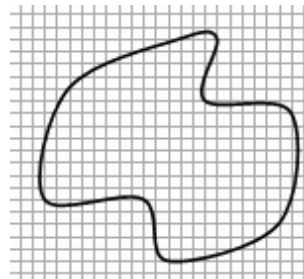


You can use multiplication to find how many square inches this rectangle covers:  $2 \text{ in} \times 4 \text{ in} = 8 \text{ in}^2$ .



Here again multiplication does the trick:

$$\text{Area} = 8 \text{ km} \times 4 \text{ km} = 32 \text{ km}^2.$$



If the figure is some other shape than a rectangle, we still use little squares to measure its area. It is just more difficult to find out how many little squares it covers, and we may have to use partial (fractional) squares as well.

You can find the area of a rectangle by multiplying the side lengths.

**Independent Work:**

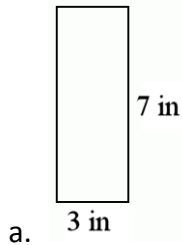
**8) Draw a square with the *area* of...**

**a. 4 square inches**

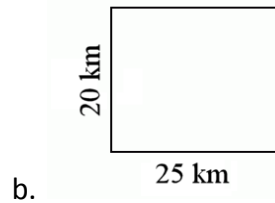
**b. 9 square centimeters**

**c. 1 square foot (on a separate paper)**

**d. Find the areas of the rectangles when the sides are known. \*Remember to use the right unit for area.**

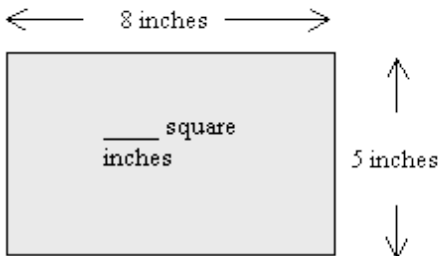


A = \_\_\_\_\_

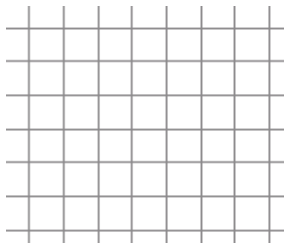
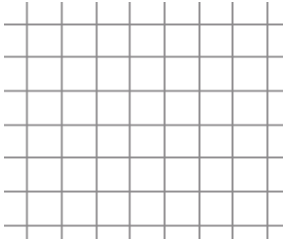
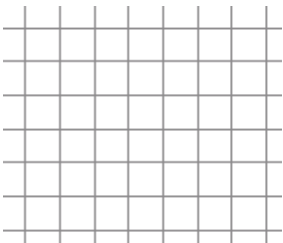


A = \_\_\_\_\_

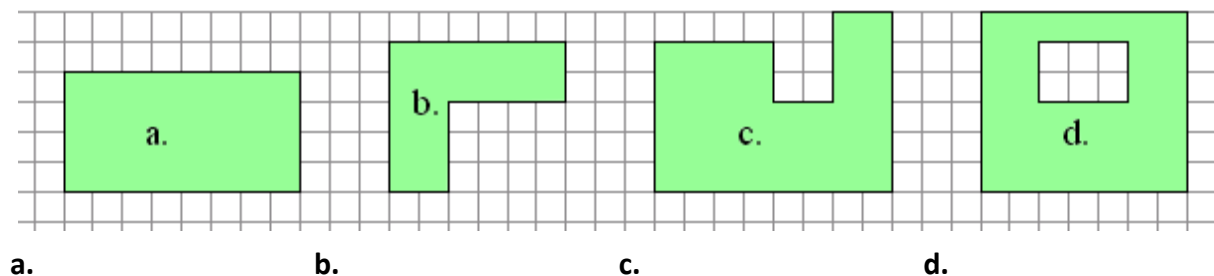
**e. Find the area of the following dimension.**



f. Draw a figure. (Note: Question C is more advanced and may require additional support.)

 <p>a. A rectangle with an area of 20 square units</p>	 <p>b. A square with an area of 16 square units</p>	 <p>c. An L-shape with an area of 18 square units</p>
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g. How many square units are in the area of these shaded shapes? Remember to label with square units.



# 9) Differentiation/Small Groups:

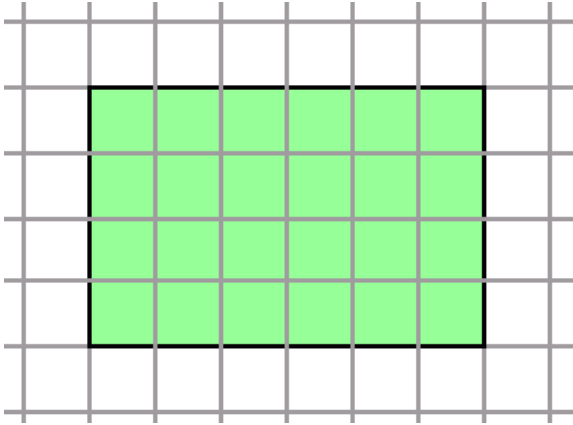
## Group A (Beginner Group):

Draw three different rectangles that have the area of 30 square units.



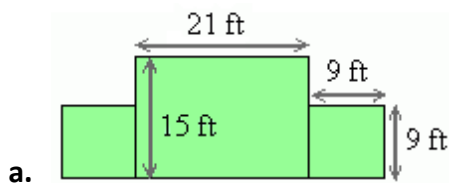
**Group B (Intermediate):**

The side of each *little* square is 3 cm. What is the area of the shaded rectangle? Don't get fooled!



**Group C (Advanced):**

Challenge. Find the areas of the shaded figures. In (b), divide the figure into two rectangles.



b.

**Wrap-up:**

Students will write to the following prompt in their math journals.

- 👉 Describe a situation outside of school in which you might have to calculate area. What formula and unit would you use?

## DEPTH OF KNOWLEDGE LEVELS (DOK)

**DOK Level 1:** Students apply the formula *length* x *width* to calculate area.

**DOK Level 2:** Students select appropriate units and calculate area correctly.

## UDL SUPPORT STRATEGIES

### Representation

- ✓ Display book for students to see pictures and listen as text is read aloud.
- ✓ Teacher models on the SMART board before students practice.
- ✓ Students will use vocabulary sheets with written and visual definition for key vocabulary.
- ✓ Enlarge graph paper.

### Action and Expression

- ✓ Post goals, objectives, and schedules of what is expected.
- ✓ Provide alternatives in the requirements for rate and speed on task.
- ✓ Students select appropriate measuring tools.
- ✓ Guided practice has prompts to scaffold learning.
- ✓ Provide opportunities for students to self-monitor their progress.
- ✓ Scaffold such as checklists for self-assessment.

### Engagement

- ✓ Opportunities for students to share their understanding and critique the reasoning of others during Turn and Talk.
- ✓ Small group interaction with differentiated practice using measuring tools.
- ✓ Vary activities so that they are age- and ability-appropriate.
- ✓ Include visual timers to help students self-monitor.
- ✓ Foster collaboration through partner activities to discuss and share solutions.
- ✓ Create expectations for group work.
- ✓ Teachers give ongoing feedback on student progress.

Lesson adapted from [HomeschoolMath.net](http://HomeschoolMath.net)



Name \_\_\_\_\_ Date \_\_\_\_\_

## Measurement - Area Hunt

Find the area of each object. Use the appropriate unit of measurement when finding the length and width. HAVE FUN!!!!

Object	Unit of Measurement	Length	Width	Area
Math Textbook				
Pink Eraser				
Student Desktop				
Light Switch				
Window in Door				
Floor Tile				
White Board Eraser				
SMART Board				

Lesson adapted from [HomeschoolMath.net](http://HomeschoolMath.net)

Name: \_\_\_\_\_

Date: \_\_\_\_\_



## The Area of It All

### Student Packet

Look at me!  
I can do the green section *all by myself*.

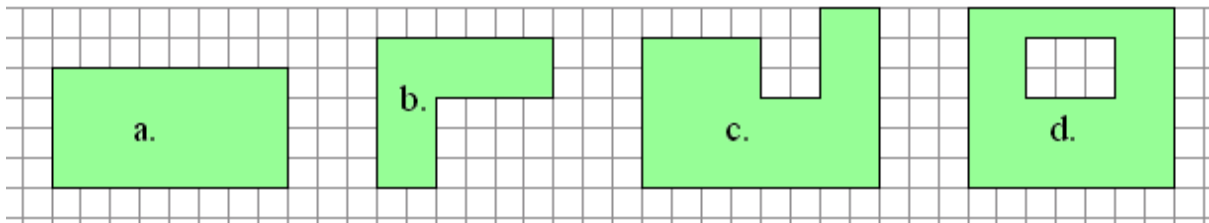
1. Draw a square with the *area* of...

a. 4 square inches

b. 9 square centimeters

c. 1 square foot (on a separate sheet of paper)

2. How many square units are in the area of these shaded shapes? Remember to label with square units.



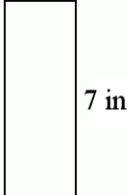
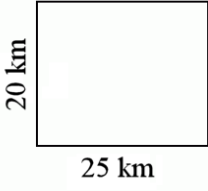
a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

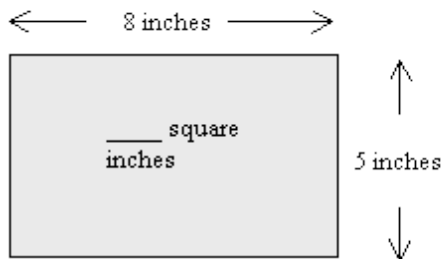
d. \_\_\_\_\_

3. Find the areas of the rectangles when the sides are known.

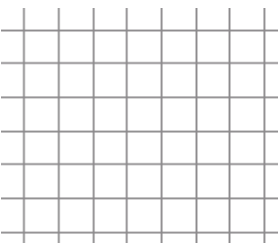
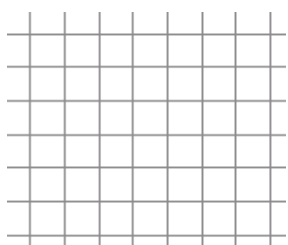
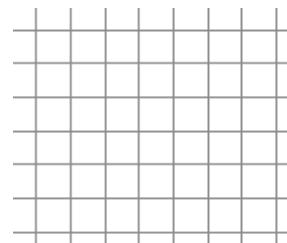
<p>a.</p>  <p>Area = _____</p>	<p>b.</p>  <p>Area = _____</p>
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\*Remember to use the right unit for area.

4. Find the area of the following dimension.



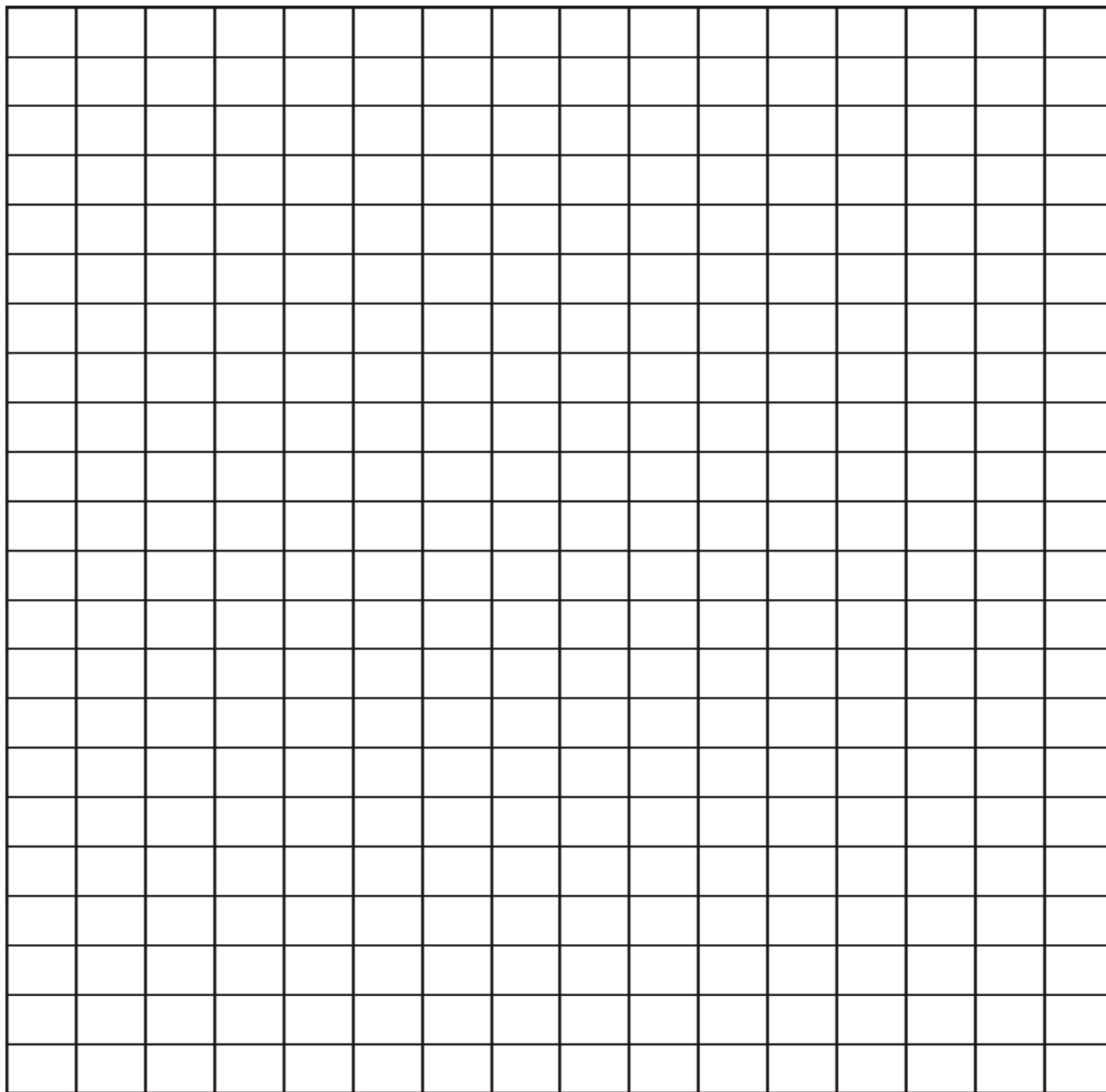
5. Draw a figure in the space provided.

 <p>a. A rectangle with an area of 20 square units</p>	 <p>b. A square with an area of 16 square units</p>	 <p>c. An L-shape with an area of 18 square units</p>
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Look at me!

I can do the purple section *with a friend or many friends.*

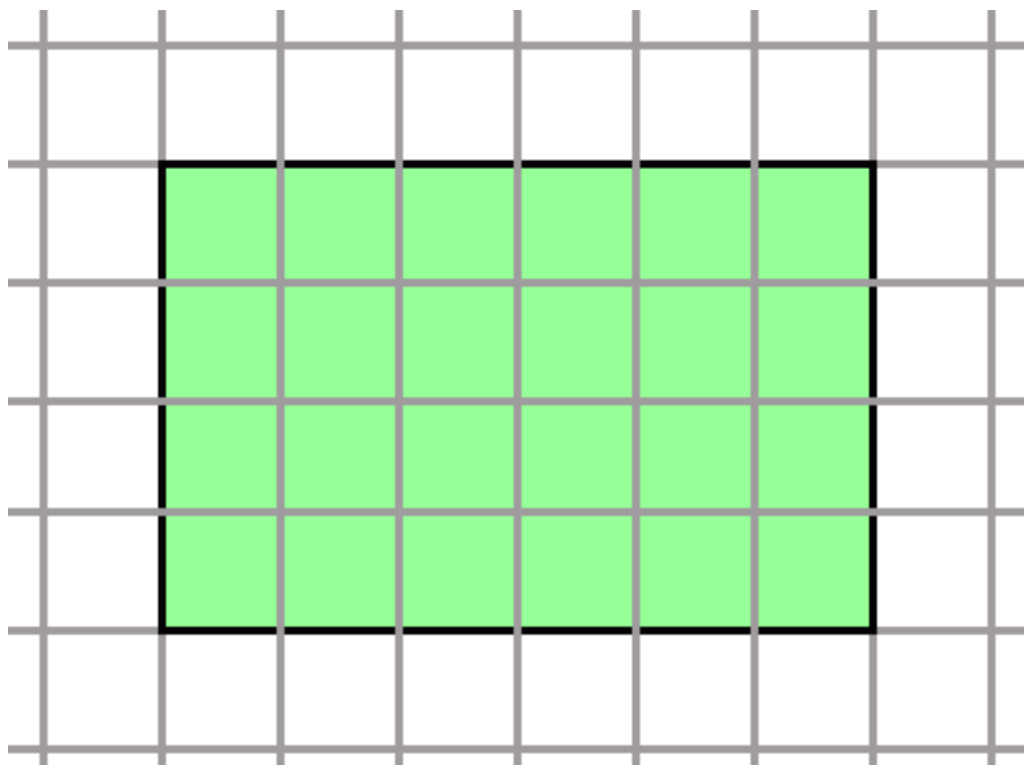
**Draw three different rectangles that have the area of 30 square units.**



Look at me!  
I can do the purple section *with a friend or many friends*.

The side of each unit square is 3 cm.

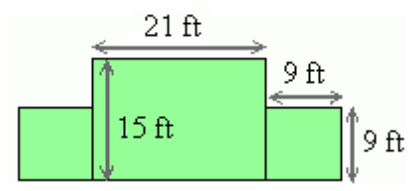
How many square centimeters make up the shaded rectangle? Don't get fooled!



Explain your mathematical thinking.

Look at me!  
I can do the purple section *with a friend or many friends*.

In (a), find the areas of the shaded figures. In (b), divide the figure into two rectangles.

<p>a.</p> 	<p>b.</p>
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Explain your mathematical thinking.

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# Will We All Fit?

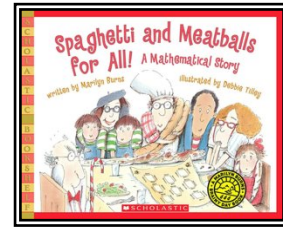
**Topic:** Perimeter and Area

**Duration:** 90-Minute Math Block

**Materials/Instructional Resources:**

*Spaghetti and Meatballs for All* by Marilyn Burns  
 1" x 1" tiles  
 Carpet tiles (suggested)  
 Chart paper  
 Straightedge

Grid paper  
 SMART board  
 Markers  
 Student copies of "Seating Chart" worksheet



## OBJECTIVE(S)

- Students will calculate area by counting square units or by using multiplication as a strategy.
- Students will calculate perimeter by counting unit squares or by adding side lengths.
- Students will represent their work with equations.

## ESSENTIAL QUESTION(S)

- How can we apply our knowledge of the relationship between perimeter and area to solve real-world problems?

## COMMON CORE STANDARDS

- **3.MD.7a:** Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths.
- **3.MD.7b:** Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real-world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning.
- **3.MD.8:** Solve real-world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same areas and different perimeters.

## MATHEMATICAL PRACTICES

- MP.1** Make sense of problems and persevere in solving them.  
**MP.2** Reason abstractly and quantitatively.  
**MP.3** Construct viable arguments and critique the reasoning of others.  
**MP.4** Model with mathematics.  
**MP.5** Use appropriate tools strategically.  
**MP.6** Attend to precision.

## KEY TERMS AND VOCABULARY

## LEARNING PLAN

**Whole Group Instruction:** 1) Explain to students that they are going to read the story *Spaghetti and Meatballs for All* by Marilyn Burns and complete an activity related to area and perimeter. Display the book and provide a brief introduction about the Comforts and the family reunion they are planning, telling them the following: “Mr. and Mrs. Comfort want to have a banquet for many people, and lots of math is involved in the planning. They need to know how much food they’ll need, the amounts of the ingredients to make it, and how to make sure that everyone coming has a place to sit.” Discuss the problems Mr. and Mrs. Comfort face during their family reunion. Review the facts presented in the book:

- a) Thirty-two people are coming to the reunion.
- b) Mrs. Comfort has ordered 8 square tables for the guests.
- c) As the guests arrive, tables are rearranged to accommodate seating.

### **Active Engagement:**

2. Pass out 8 square carpet tiles (or 1” x 1” tiles) to each student or pair of students.

3. As the teacher reads the book, students arrange the tiles according to the table arrangements. With each arrangement, students record the guests seated, the table arrangement, the perimeter, and the area of the tables on the seating chart. Ask: What is the perimeter of each table if the top of each table has an area of 1 square unit? Teacher guides students to make the connection between arranging the tiles and array models.

4. Students rearrange the tiles each time more company comes and record the data, while the teacher models and records the process on the SMART board or on chart paper.

5. Discuss what is happening to the perimeter and area of the tiles each time the seats are changed. Talk about the size of each arrangement and the number of people the new arrangement seats.

6. Have students come to the SMART board or write on chart paper the different arrangements on the overhead after students have had time to explore and the teacher has had time to observe the manipulation of tiles.

7. Ask: How do you think Mrs. Comfort's problem will be solved? What do you think will happen next in the story?

8. At the end of the story, draw the table arrangement on the board. Discuss that students already know the perimeter of the arrangement is 32 units, since that is how many people could fit around the 8 tables.

### **Independent Practice:**

Have students use their tiles and grid paper to investigate the following problem:

Mrs. Comfort is having a birthday party for Mr. Comfort and has invited 48 guests. She has ordered only 12 tables. Create as many seating plans as possible to accommodate Mr. and Mrs. Comfort’s guests.

### **Wrap-up:**

Students share possible solutions and seating plans with the class. Have students respond to the following questions in their math journals:

- ✓ How can we calculate the area of the arrangement?
- ✓ How does combining the area of several tables help Mrs. Comfort solve her problem?
- ✓ If shapes have the same area, do they always have the same perimeter? Explain your answer.
- ✓ Encourage students to draw examples from their observations to support their ideas.



## UDL SUPPORT STRATEGIES

### **Representation:**

- ✓ Utilize SMART board and Internet to download interactive storybook *Spaghetti and Meatballs for All* so that the text and illustrations can be easily viewed. <http://www.childrenslibrary.org>
- ✓ To review the definitions of area and perimeter go to animated glossary at: <http://www.hbschool.com/glossary/math2/index3.html>.
- ✓ Enlarged grid chart paper to model seating plans.
- ✓ Students use tiles to represent seating arrangements.

### **Action and Expression:**

- ✓ Facilitate resources and have students manipulate the tiles.
- ✓ Provide grid paper for students to record seating plans.
- ✓ Foster collaboration and communication through partner activities to discuss and share solutions.
- ✓ Provide a variety of ways to interact with materials allow students the opportunity to draw the area and perimeter models on enlarged grid chart paper.
- ✓ Provide graphic organizers such as “Seating Chart” organizer to help students who have difficulty with abstract concepts of organizing seating plans with different perimeters and areas.

### **Engagement:**

- ✓ Hand-on activities with tiles and grid paper.
- ✓ Seating Chart graphic organizer.
- ✓ Reduce threats and distractions by utilizing interactive storybook and animated glossary websites.
- ✓ Vary activities so that they are age- and ability-appropriate.
- ✓ Include visual timers to help students self-monitor.
- ✓ Foster collaboration through partner activities to discuss and share solutions.
- ✓ Create expectations for group work.
- ✓ Teachers give ongoing feedback on student progress.

## DEPTH OF KNOWLEDGE LEVELS (DOK)

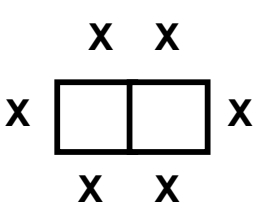
**DOK Level 1:** Students draw, label, arrange, and calculate the perimeter and area of the seating arrangements for the Comforts.

**DOK Level 2:** Students organize tiles to demonstrate perimeter and area for seating arrangements.

**DOK Level 3:** Students extend their understanding of perimeter and area to solve a new problem.

## Stitching It All Together

### Seating Chart: Will We All Fit?

Guests Seated	Table Arrangement	Perimeter	Area
Mrs. Comfort's daughter and her husband with two children; Mr. and Mrs. Comfort		6 units	2 square units

**Topic:** Area and Perimeter

**Duration:** Two non-consecutive days (45–50 minutes)

The two activities can be split between Arcs of Learning #2 and #3

**Materials/Instructional Resources:**

*The Quiltmaker's Gift* by Jeff Brumbeau

Grid paper

SMART board or chart paper

Markers/colored pencils/crayons/pencils

Straightedge/ruler

Student copies of "Seating Chart" worksheet

Geometric blocks: triangles, hexagons, squares, rhombuses, trapezoids

Activity Sheets: 9-Patch Grid, Blank Patch Grid, quilt patterns



**OBJECTIVE(S)**

- Students will compare rectangles with the same area, but different perimeters.
- Students will create repeating patterns (tessellations) using geometric shapes.
- Students will apply mathematical reasoning and measurement skills to calculate the area and perimeter of polygons.

**ESSENTIAL QUESTION**

- How are area and perimeter measured?

**COMMON CORE STANDARDS**

- **3.MD.6:** Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).  
*Secondary*
- **3.MD.7.b:** Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real-world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning.
- **3.MD.8:** Solve real-world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same areas and different perimeters.

**MATHEMATICAL PRACTICES**

- MP.1** Make sense of problems and persevere in solving them.
- MP.3** Construct viable arguments and critique the reasoning of others.
- MP.4** Model with mathematics.
- MP.5** Use appropriate tools strategically.
- MP.6** Attend to precision.

**KEY TERMS AND VOCABULARY**

Perimeter  
Quilt

Area  
Tessellations

Polygon  
Length

Pattern  
Width

Tiling

**LEARNING PLAN**

**Part 1: What is area?**

### Whole Group Instruction (30 minutes):

- 1) Begin by asking students to tell you what they know about patchwork quilts. Create a semantic map on large chart paper to record their responses. Share the definition of a patchwork quilt using Wikipedia Encyclopedia at <http://en.wikipedia.org/wiki/Patchwork>. Also show students samples of patchwork blocks at <http://www.thequiltmakersgift.com> (in the Quilt Gallery).



- 2) Explain that students will be creating their own patchwork quilt blocks. Ask them to define “pattern”. Write the definition on chart paper. A pattern is made up of a number of objects that are arranged following a rule or rules (<http://www.icoachmath.com>).
- 3) Introduce the story *The Quiltmaker’s Gift* using the SMART board. The story is available at <http://www.childrenslibrary.org>, or have a copy of the book available for students.
- 4) As you read the story ask the following key questions:
  - On page 4 – Who can find five examples of repeating patterns on this page? Briefly explain that one type of repeating pattern is called a tessellation.
  - On page 14 – How do you think the Quiltmaker made this quilt? What patterns did she use?
  - On page 41 – What different shapes make up this pattern? Review the definition of a polygon. <http://www.icoachmath.com>
  - Besides quilts, where else can you find tessellating patterns? (Buildings, sidewalks, driveways, wallpaper, wrapping paper, carpets, etc.)

### Active Engagement (15 minutes):

- 5) After reading the story, give each group of three students a bucket of geometric shapes which consist of triangles, squares, rhombuses, trapezoids, and hexagons.
- 6) Give each student a copy of the “Blank Patch Block” (see attachment). Give students 10 minutes to create a tessellating pattern using only triangles and rhombuses. After 10 minutes ask students to describe the pattern they created.
- 7) Review the definition for area (<http://www.icoachmath.com>). Make sure the students understand that there cannot be any gaps or overlaps.

### Small Group Work (20 minutes):

- 8) Have students work in groups of three or four to use their pattern blocks to explore recreating some of the patterns from the story. Have pictured copies of the patchwork blocks from *The Quiltmaker’s Gift* website available for each group to refer to as they work in their homogenous groups.
  - Group A: Distribute “Making a Quilt” traditional 9-patch pattern template (see attachment). Allow students to copy cut patterns from the book. This will help students who need more support recognizing the tessellating patterns.
  - Group B: Distribute “Making a Quilt” traditional 9-patch pattern template (see attachment) to each student. This will help students who need support with manipulating the geometric shapes into tessellating patterns.
  - Group C: Distribute a “Blank Patch Block” template (see attachment) for students who feel more comfortable creating their tessellating patterns without a grid.

### Wrap-up:

Students will respond in their math journals to the following questions: What is the relationship of one patch to the whole area of a quilt? What is a tessellating pattern? After 5 minutes ask students to share

their journal responses.

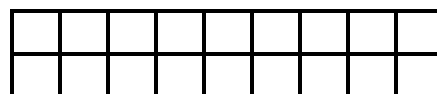
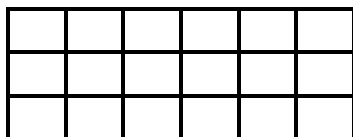
## **Part 2: How are area and perimeter measured?**

### **Whole Group Instruction (10 minutes):**

- 1) Begin the lesson by explaining that today students will be extending their knowledge of perimeter and area by creating a class patchwork quilt. Ask: How is quilt making related to perimeter and area?
- 2) Record responses on large chart paper. Students should be able to note that a quilt is in the shape of a square. The area of the quilt can be calculated by multiplying the length by the width or by counting the number of patches that were used to create the entire quilt.
- 3) Review some of the geometric patterns used in the story *The Quiltmaker's Gift*.

### **Independent/Partner Work (35 minutes):**

- 4) Distribute "Making a Quilt" traditional 9-patch pattern template (see attachment). Students can use this sheet to create tessellating patterns. Students who feel more comfortable using the large patch grid without the squares will have copies available for them to use.
- 5) Explain to students that we will be making a patchwork quilt in which each block is a square unit.
- 6) Give students the option of working independently or in pairs to create their quilt patches. Have crayons or colored pencils available for students to color their patterns.
- 7) After approximately 20 minutes, stop students and have 18 students (if in a large class) assemble their patches in a rectangle on the rug or floor. If the class is small, choose 3 or 6 students to assemble their patches in a rectangle on the rug or floor. Ask: What is the distance around the quilt? Answer: Varies. Students will calculate perimeter. Ask: How many rows of patches do we now have? How many patches are in each row? Answer: Varies. Ask: How many columns of patches do we now have? How many patches are in each column? Answer: Varies. Ask: How can we calculate the area using multiplication? Answer: *Length x width*. Ask: How can we calculate the area by counting?
- 8) Ask: Is there another way we can arrange the patches? Ask: What is the perimeter? Ask: What is the area? Students will discover that the perimeter changes, but the area is the same.



- 9) Extension Activity: Have students use more patches to make their quilt. It may be necessary to have some extra ready-made patches prepared. Students will calculate the perimeter and area of each rectangular quilt.

### **Wrap-Up:**

- 10) Students will complete an Exit Slip: How are area and perimeter measured? How are they related?

## **UDL SUPPORT STRATEGIES**

### **Representation:**

- ✓ Utilize SMART board and Internet to download interactive story *The Quiltmaker's Gift* so that the text and illustrations can be easily viewed.  
[http://www.childrenslibrary.org/featuredbooks/2006\\_08\\_28.shtml](http://www.childrenslibrary.org/featuredbooks/2006_08_28.shtml)
- ✓ To review the definitions of area and perimeter go to animated glossary at:  
<http://www.hbschool.com/glossary/math2/index3.html>.
- ✓ Provide graphic organizers such as semantic web for quilts to help students activate prior knowledge about the topic.
- ✓ Patch templates and sample patchwork patterns to help students create tessellation representations.

**Action and Expression:**

- ✓ Students will manipulate geometric pattern blocks to aid them in creating tessellating patterns.
- ✓ Provide students with pre-made patchwork patterns from <http://www.quiltmakersgift.com> website to help student practice coloring in a variety of patterns.
- ✓ Foster collaboration and communication through whole group, partner, and small group activities to discuss strategies.
- ✓ Provide a variety of ways to interact with materials by allowing students the opportunity to draw the area and perimeter models.

**Engagement:**

- ✓ Hands-on activities with geometric pattern blocks.
- ✓ Enhance visual and interactive learning by utilizing the online storybook and animated glossary websites.
- ✓ Foster collaboration through partner activities to discuss strategies and share solutions.
- ✓ Create expectations for group work.
- ✓ Teachers give ongoing feedback on student progress.

**DEPTH OF KNOWLEDGE LEVELS (DOK)**

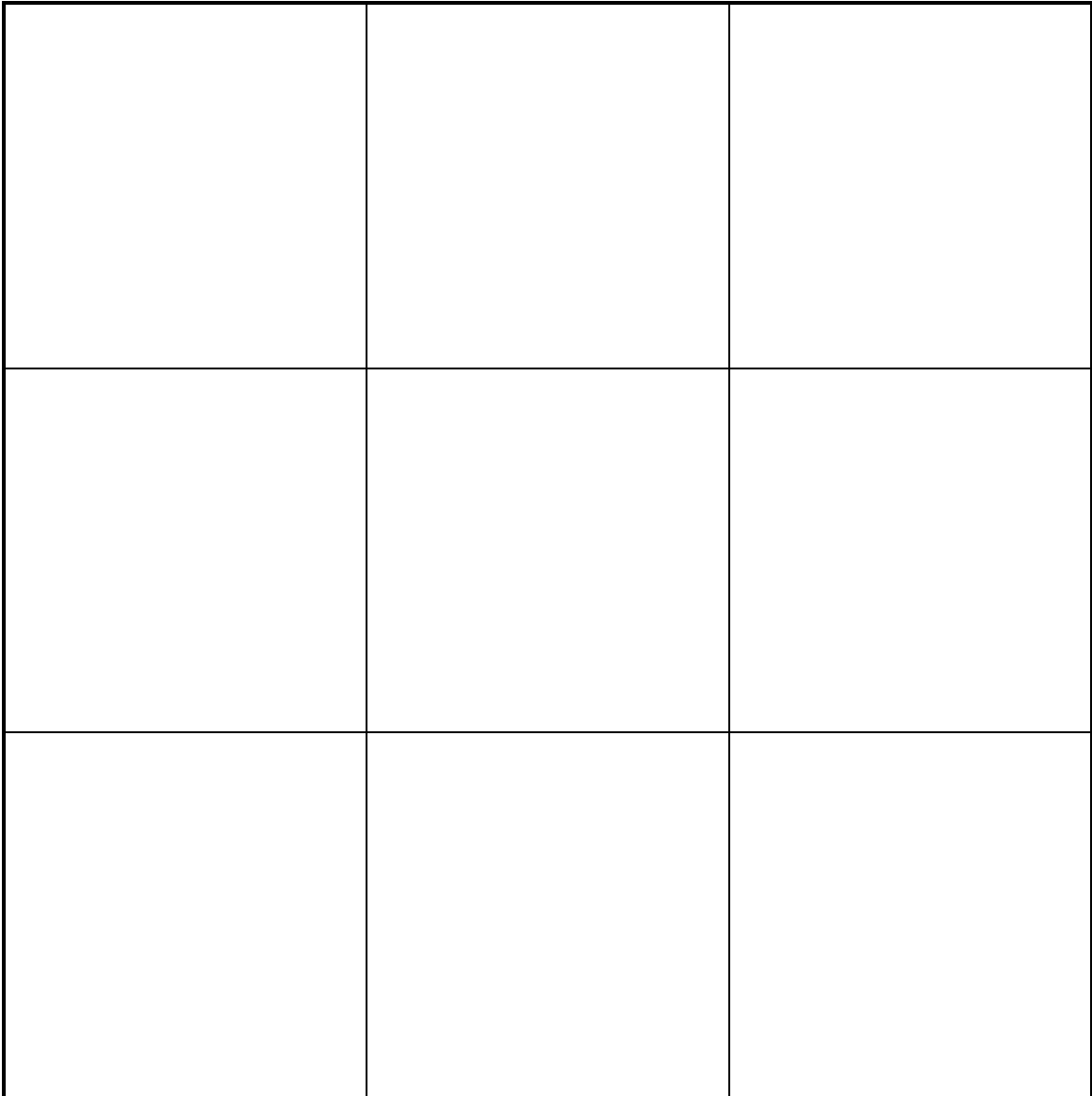
**DOK Level 1:** Students draw, label, arrange, and calculate the perimeter and area for each patchwork pattern. Students accurately measure the length and width of their patchwork quilt patterns.

**DOK Level 2:** Students organize and create patterns using geometric pattern blocks.

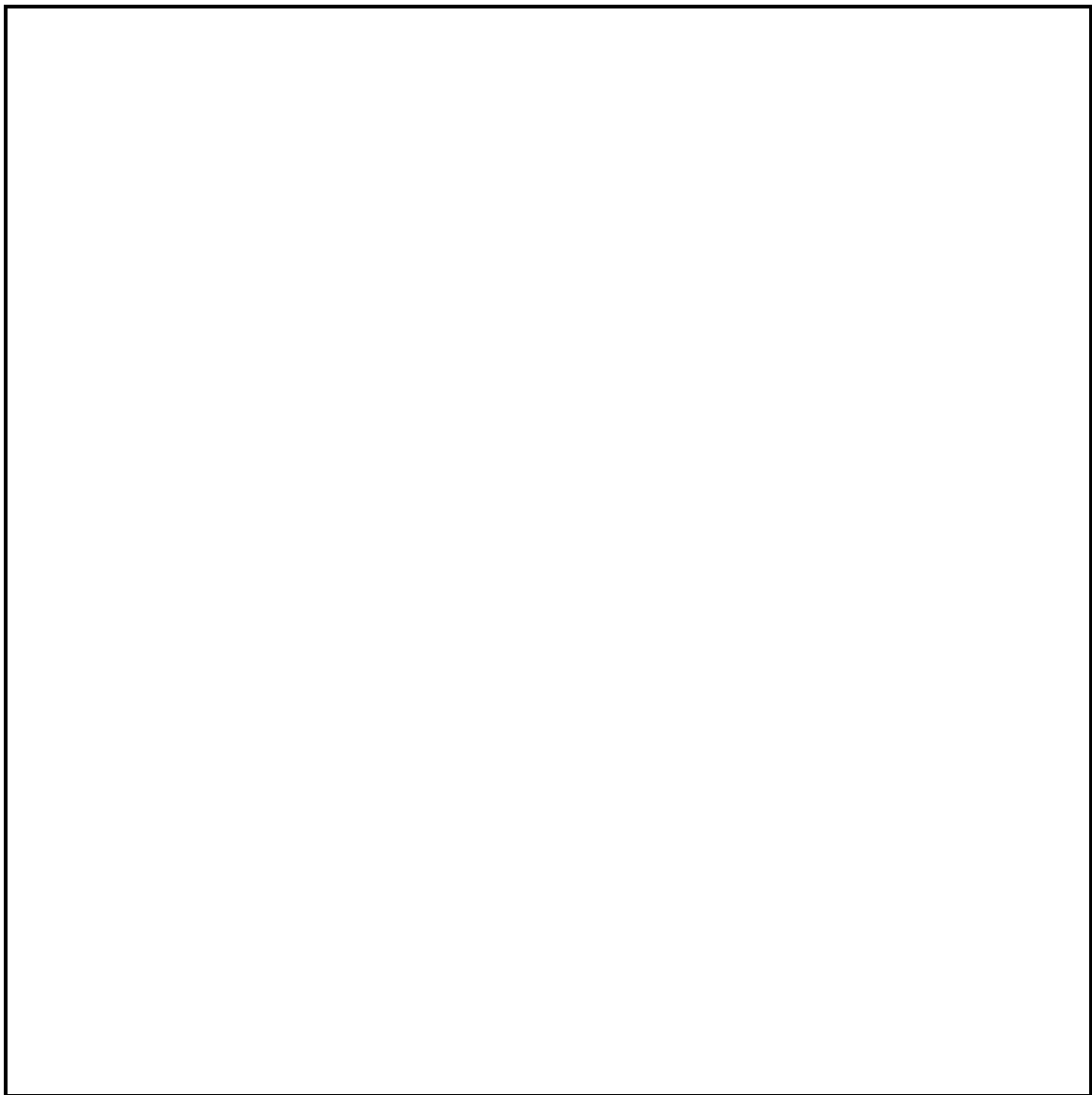
**DOK Level 3:** Students extend their understanding of perimeter and area by designing patchwork quilt patterns.

**DOK Level 4:** Students apply their understanding of area and perimeter by creating a class patchwork quilt mural and creating hypotheses on which arrangements will create smaller or larger dimensions.

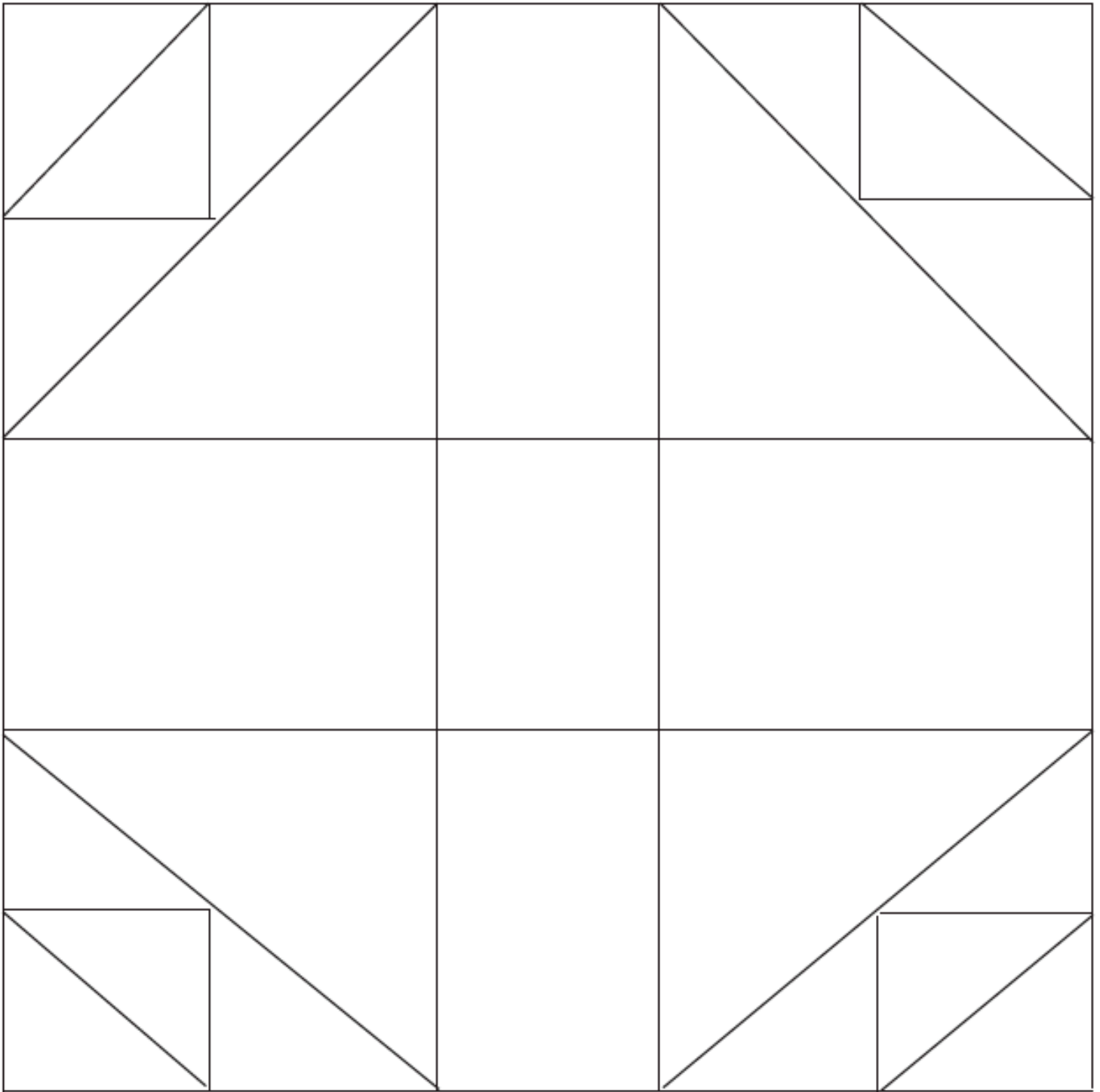
## 9-Patch Grid Block



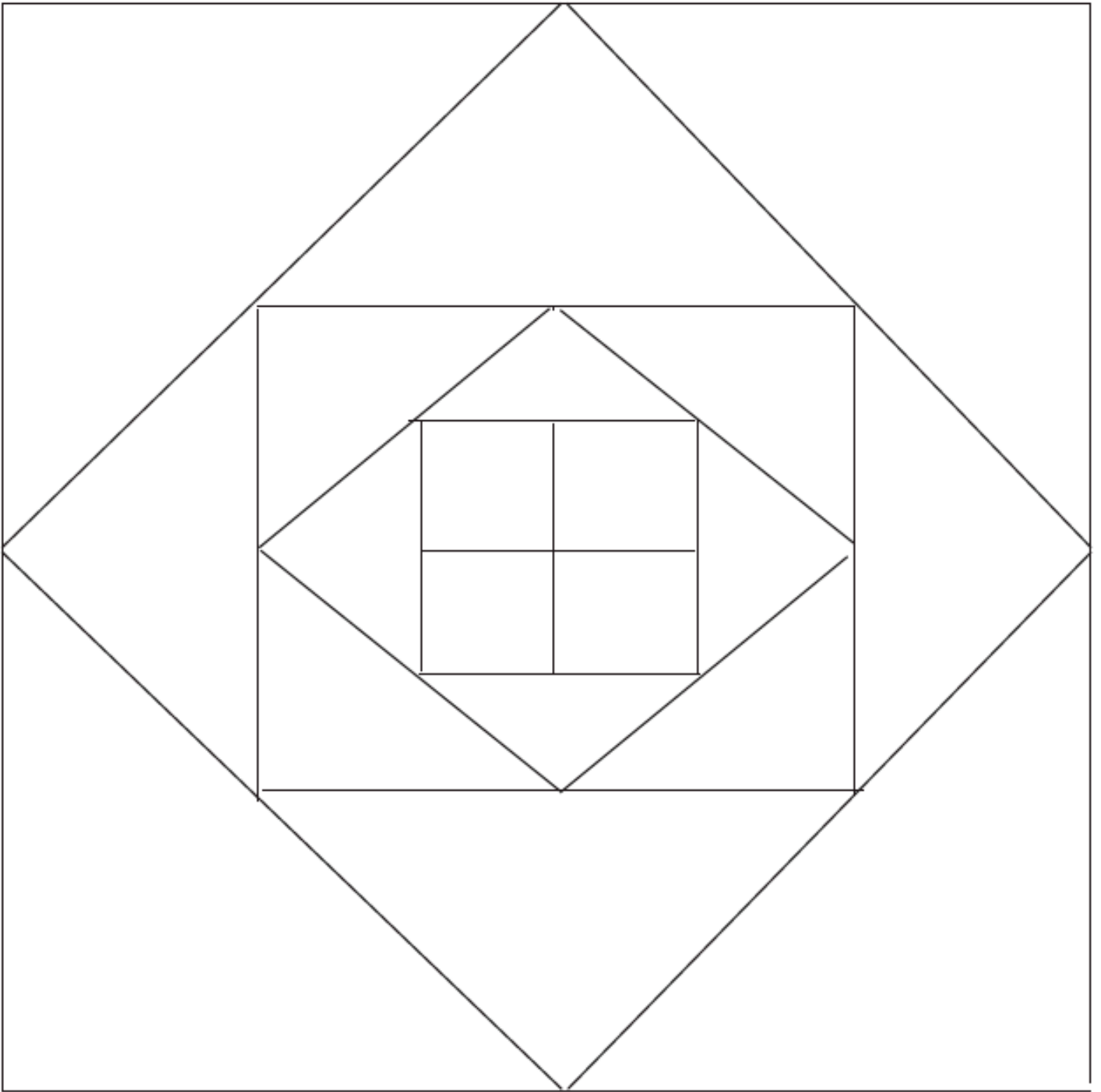
## Blank Patch Block



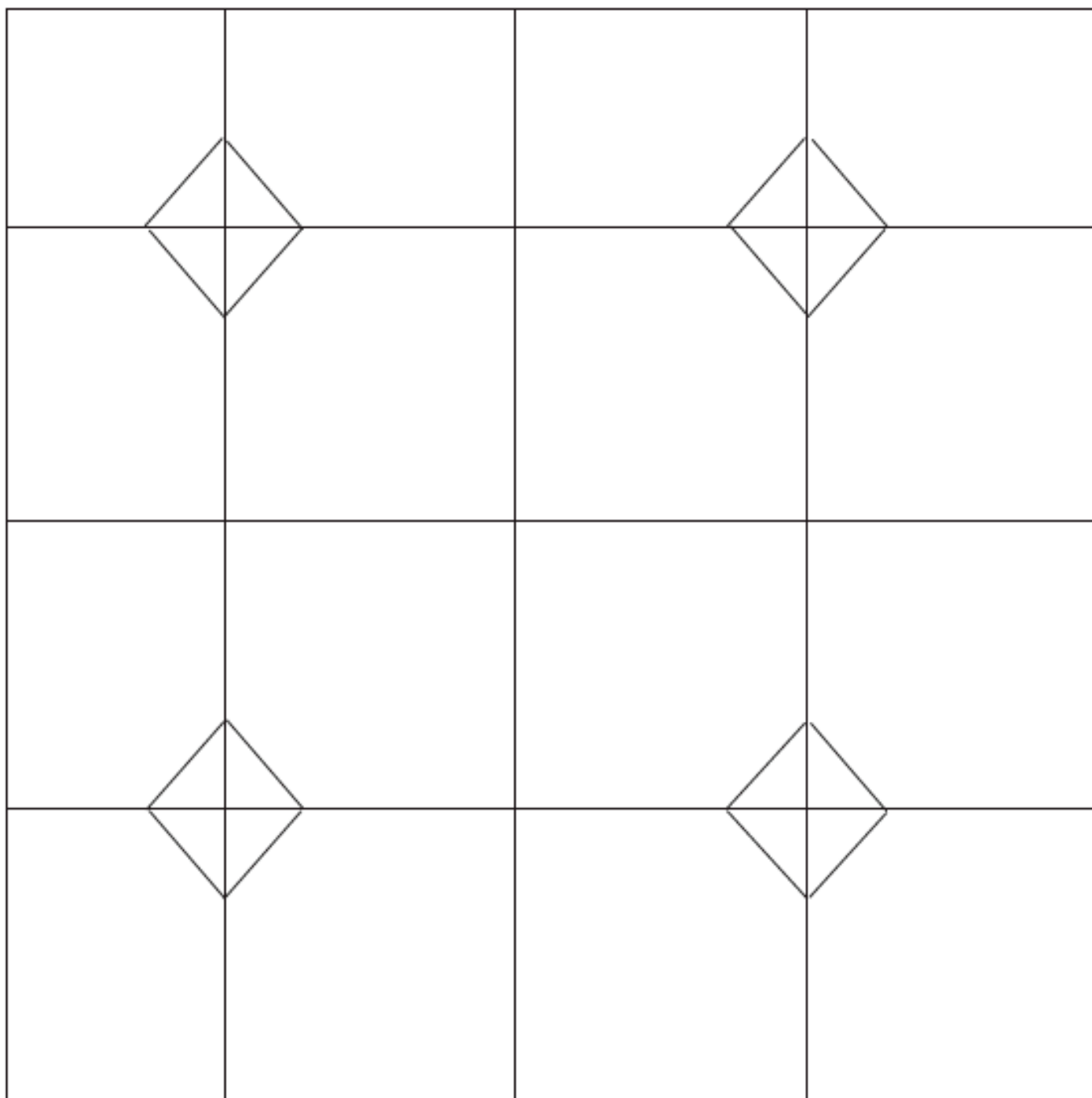




Adapted from <http://www.quiltmakersgift.com>



Adapted from <http://www.quiltmakersgift.com>



Adapted from <http://www.quiltmakersgift.com>



## GRADE 3 MATH: CHRIS' GARDEN DILEMMA

### INSTRUCTIONAL RESOURCES

# GRADE 3 MATH: CHRIS' GARDEN DILEMMA

## INSTRUCTIONAL RESOURCES



### 3.MD.5

#### Task: Exploring Area

**Materials:** cardstock rectangles of various sizes (or envelopes), color tiles, grid paper

1. Choose 4 different rectangles and trace around each one on paper.
2. Use color tiles to measure the area of each rectangle.
3. Record your findings using pictures, numbers, and words.

What is the difference in area between the *smallest* and *largest* rectangles? Explain.

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Adapted from © K–5 MathTeachingResources.com

### 3.MD.5

#### Task: Area on the Geo-board

**Materials:** geoboards, rubber bands, geo-board paper, rulers

Make a one-by-one square on your geo-board. This square has an area of 1 square unit and can be used as a measure for finding the area of geo-board shapes.

1. How many different shapes with an area of 10 square units can you make on your geo-board?
2. Record each shape you make on geo-board paper.
3. Choose two of the shapes you recorded and explain how you measured the area of each shape.

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### 3.MD.6

#### Task: Comparing Rectangles

**Materials:** 1-inch square color tiles, pack of rectangle templates on cardstock

1. Choose a rectangle and trace around it on a sheet of paper. Estimate how many color tiles it will take to cover the rectangle. Record your estimate.
2. Place color tiles on the rectangle to check your estimate. Record your results next to your estimate.
3. Try it again with two other rectangles.
4. Label the rectangles with the smallest and largest area.
5. Explain the difference between the smallest and largest area. How did you figure that out?

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### 3.MD.7

#### Task: Developing a Formula for the Area of a Rectangle

**Materials:** cm. grid paper, straightedge

1. Work with a partner. Draw 8–12 rectangles of different sizes on cm. grid paper.
2. Collect data on the length, width, and area of each rectangle and record this information in a table.

Rectangle	Length	Width	Area
A	cm.	cm.	
B	cm.	cm.	
C	cm.	cm.	

3. Using the data in the table above, explain the relationship between the linear measurements of a rectangle and the area of that rectangle.

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Adapted from © K–5 MathTeachingResources.com

### 3.MD.8

#### Task: Rectangles with Color Tiles

**Materials:** 1-inch square color tiles

1. How many different rectangles can you make using 18 color tiles?
2. Record each rectangle you make.
3. Record the area and the perimeter for each rectangle.
4. How are the rectangles you made alike? How are they different? Explain your thinking.

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Adapted from © K–5 MathTeachingResources.com

### 3.MD.8

#### **Task: Constructing a Rabbit Enclosure**

**Materials:** straightedge and/or grid paper

1. James has 20 feet of fencing to build a rectangular enclosure on the grass for his pet rabbit. Record all the possible designs for the rabbit enclosure.
2. Which design would provide the largest grass area for the rabbit? Show your work.
3. What is the difference between the largest and smallest possible grass areas?

Adapted from © K–5 MathTeachingResources.com

### 3.MD.8

#### **Task: The Perimeter Stays the Same**

**Materials:** color tiles (in<sup>2</sup>), square-inch grid paper

1. Construct different rectangles with square color tiles. Each rectangle must have a perimeter of 42 inches.
2. Draw each rectangle on square-inch paper.
3. Find and record the areas of the rectangles.
4. Can you find the rectangle with the greatest area that has a perimeter of 42 inches? How can you prove that this rectangle has the greatest area?

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### 3.MD.8

#### Task: The Area Stays the Same

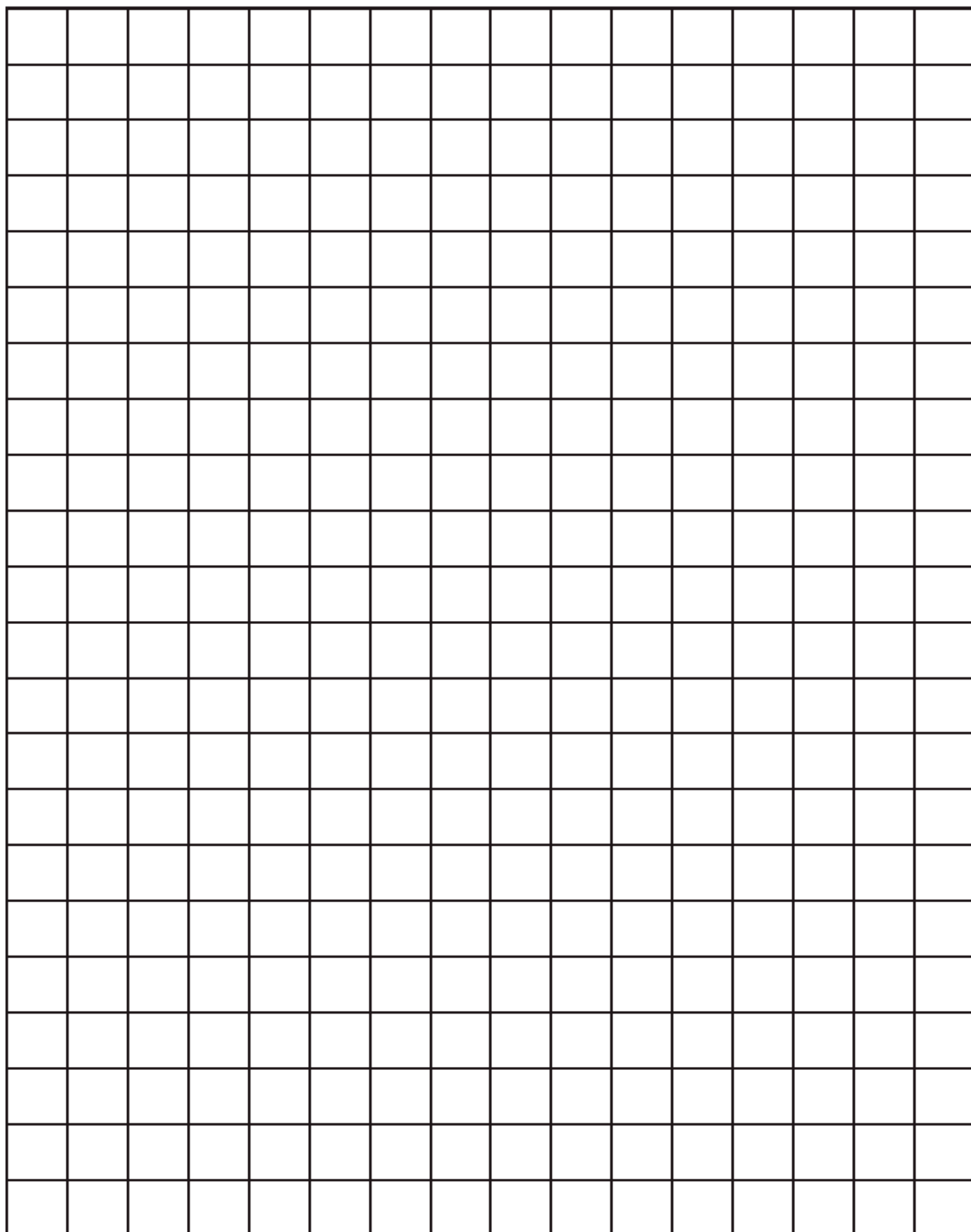
**Materials:** color tiles ( $\text{in}^2$ ), square-inch graph paper

1. Construct three different rectangles with square color tiles. Each rectangle must have an area of 36 square inches.
2. Draw each rectangle on square-inch graph paper.
3. Find and record the perimeter of the three rectangles.
4. Which rectangle has the greatest perimeter?

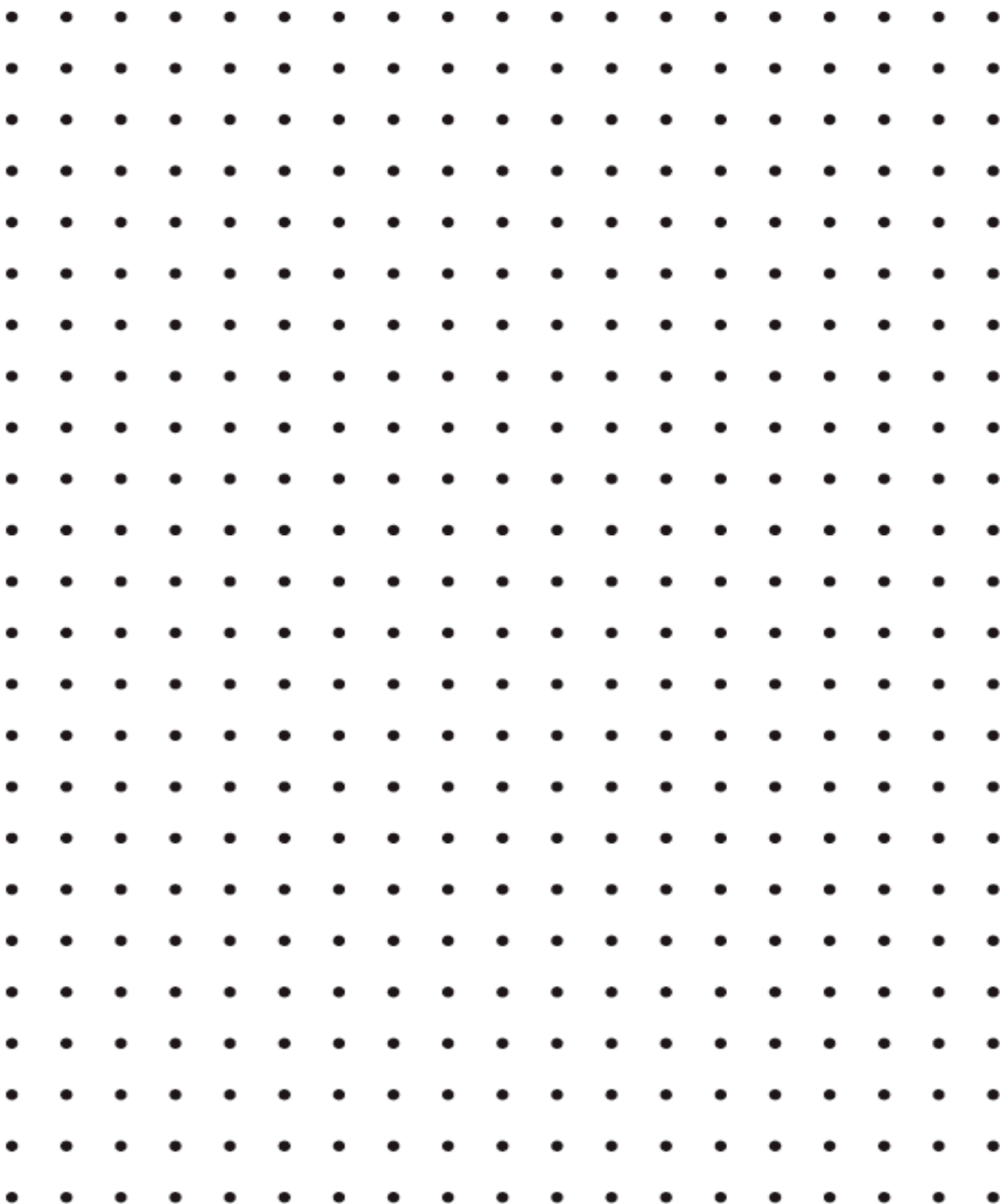
Answer: \_\_\_\_\_

Adapted from © K–5 MathTeachingResources.com

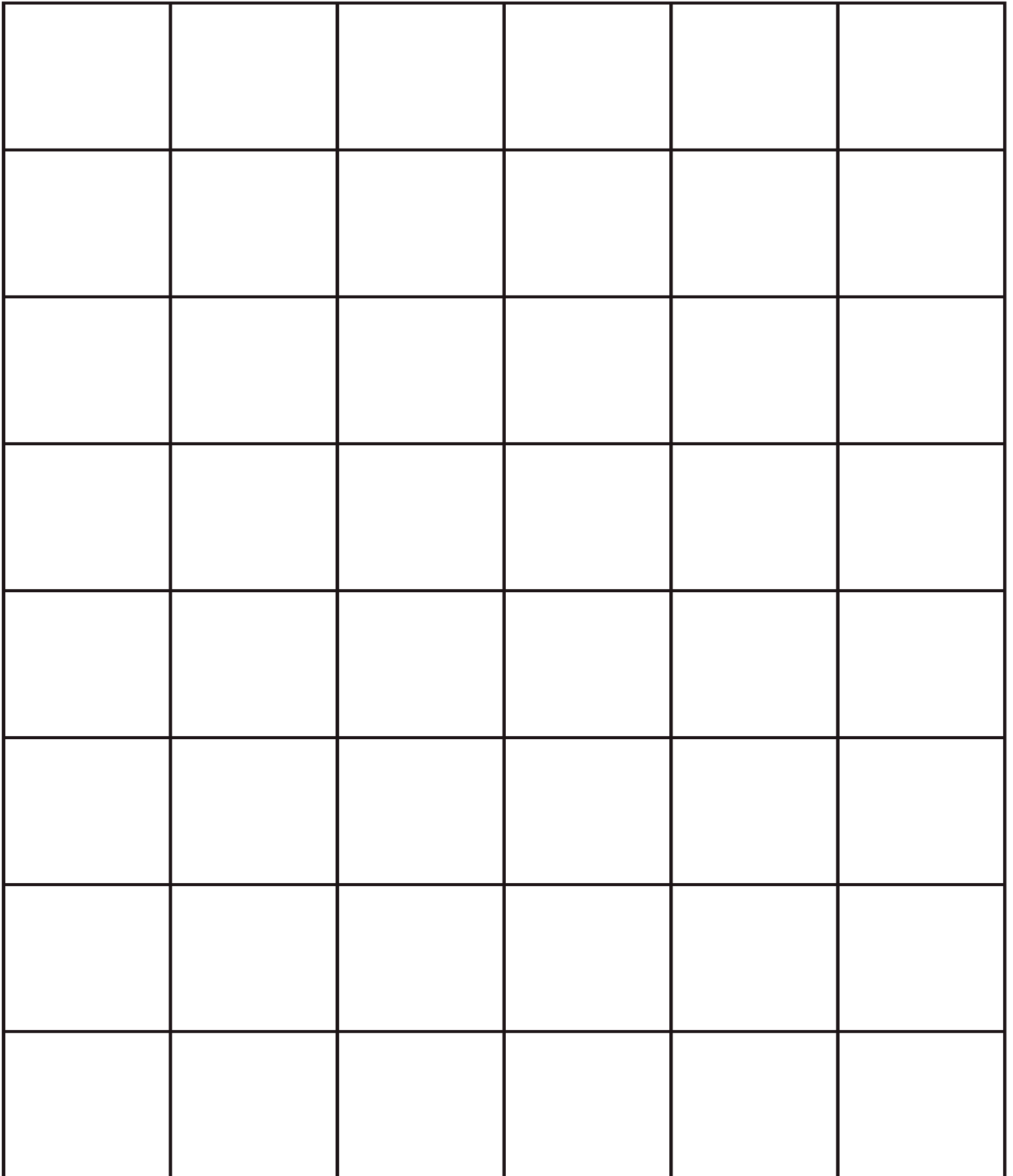
## Centimeter Grid Paper



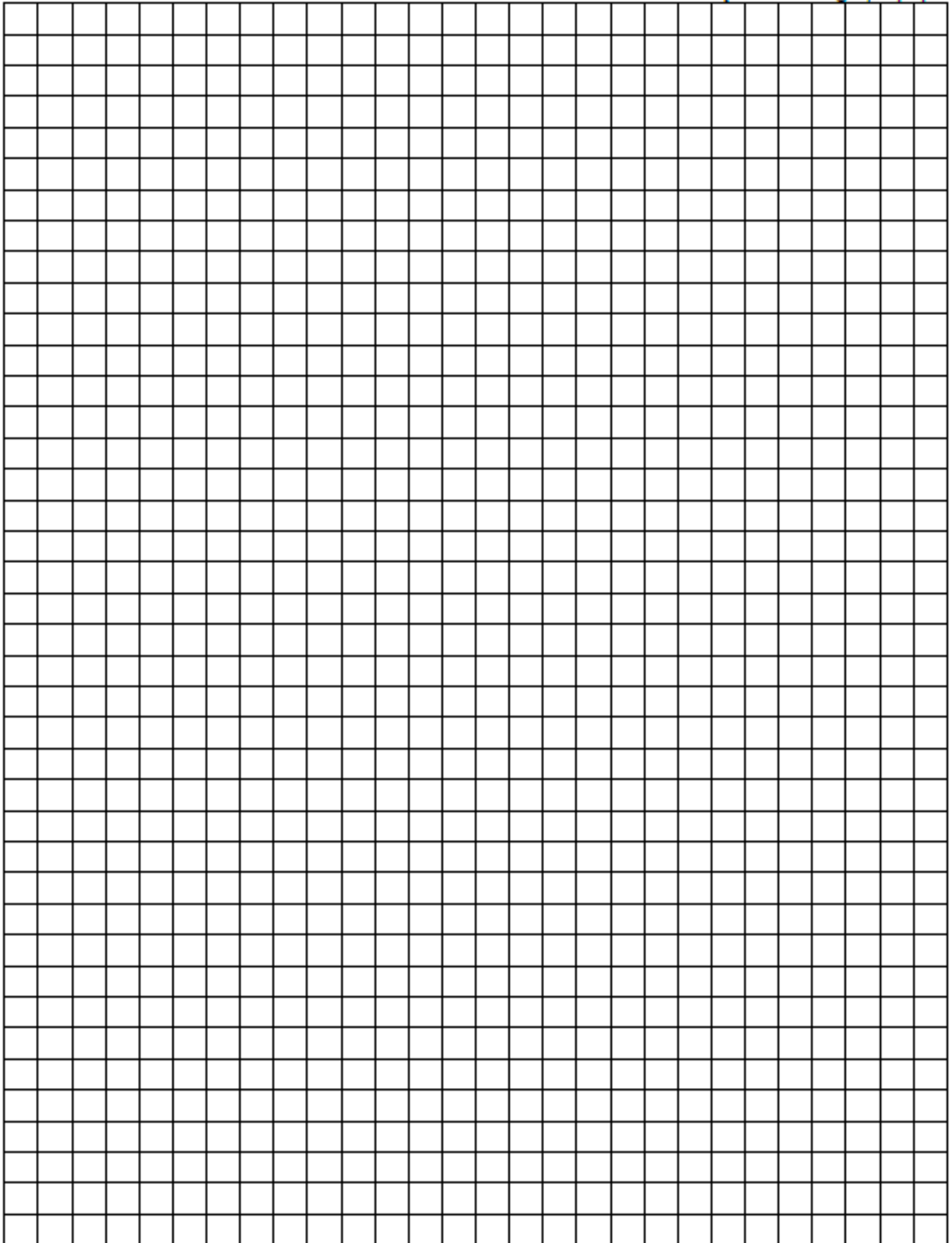
## Dot Paper



## 1-Inch Grid Paper



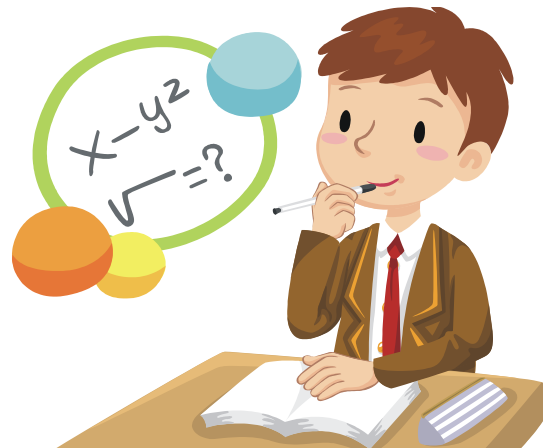




# Problem Solving Strategies

Show What You Know:

- Draw a Picture
  - Make an Organized List
  - Make a Table
  - Make a Graph
  - Act It Out
  - Use Objects
- ✓ Look for a Pattern
  - ✓ Try, Check, Revise
  - ✓ Write an Equation
  - ✓ Use Reasoning or Logic
  - ✓ Work Backwards
  - ✓ Solve a Simpler Problem



## Tips for Writing Good Math Explanations

**A good explanation should be:**

Correct

Simple

Complete

Easy to understand

**Math explanations can use:**

Words

Pictures

Numbers

Symbols

## Resources

**Websites for Students:** Interactive games with perimeter and area:

- 👍 <http://www.beaconlearningcenter.com/WebLessons/FenceMeIn/>
- 👍 <http://pbskids.org/cyberchase/math-games/airlines-builder/>
- 👍 <http://pbskids.org/cyberchase/media/games/perimeterarea/index.html>
- 👍 [www.mathplayground.com/area\\_perimeter.html](http://www.mathplayground.com/area_perimeter.html)
- 👍 <http://www.ixl.com/math/grade-3>
- 👍 <http://www.adaptedmind.com/p.php?tagId=1151#>
- 👍 <http://www.internet4classrooms.com>
- 👍 <http://beaconlearningcenter.com/weblessons/adamant/>
- 👍 <http://www.aaastudy.com/geo.htm#topic12>
- 👍 [http://www.abcy.com/third\\_grade\\_computers.htm](http://www.abcy.com/third_grade_computers.htm) (measurement)
- 👍 <http://aaamath.com/B/grade3.htm#topic186> (measurement)

**Websites for Teachers:** The following websites have lessons and activities on perimeter and area:

- 👍 <http://www.mrnussbaum.com>
- 👍 <http://www.k-5mathteachingresources.com>
- 👍 [http://www.mathgoodies.com/lessons/toc\\_vol1.html](http://www.mathgoodies.com/lessons/toc_vol1.html)
- 👍 <http://www.teacherspayteachers.com> – Festive Measurement: Area & Perimeter
- 👍 <http://www.k-5MathTeachingResources.com>
- 👍 <http://www.hbschool.com/glossary/math2/index3.html>
- 👍 <http://www.k6-geometric-shapes.com/perimeter-worksheets.html>
- 👍 <http://www.mathactivities.net/lessons/area-and-perimeter-activity.htm>
- 👍 <http://www.readtennessee.org>
- 👍 <http://www.tlsbooks.com>
- 👍 <http://www.teachersnotebook.com>

**Children's-Related Literature:**

- 👍 Burns, Marilyn. *Spaghetti and Meatballs*. New York: Scholastic Paperbacks, 2008. Lexile Level: 420, Reading Level: 3.5.
- 👍 Neuschwander, Cindy. *Sir Cumference and the Isle of Immeter*. Watertown, MA: Charlesbridge Publishing. Lexile Level: 630, Reading Level: 3.6.

**Informational Articles for Teachers:**

- 👍 Parrish, Sherry. "Number Talks Build Numerical Reasoning," *Teaching Children Mathematics/The National Council of Teachers of Mathematics* 18: 3 (October 2011).
- 👍 Bresser, Rusty. "Helping English Language Learners Develop Computational Fluency," *Teaching Children Mathematics/The National Council of Teachers of Mathematics* 9: 6 (February 2003).